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MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEATS, 1943 CROP <sup>1/</sup>

by

C. C. Fiffield, Baking Technologist, and J. A. Clark, Senior Agronomist, Wheat Investigations, Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering; Ray Weaver, J. F. Hayes, and T. F. Hartsing, Assistant Grain Technologists; and E. Hoffecker and B. E. Rothgeb, Associate Grain Technologists, Grain Products Branch, Office of Distribution

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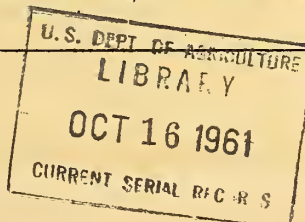
INTRODUCTION

Samples of some of the standard varieties and new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region <sup>2/</sup> of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread by a number of different methods to determine their quality characteristics. Three of the regular baking methods used for the 1939, 1940, 1941 and 1942 crops were continued for most of the experiments and also bromate response methods as used in the 1941 and 1942 report were made on a selected group of hard red spring and hard red winter wheats comparatively grown at Sheridan, Wyo.

1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, and Office of Distribution, War Food Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring-wheat region.

2/ Clark, J. A. Results of spring-wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1943, with averages for 1929 to 1943. U. S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils, and Agr. Engin., Div. Cereal Crops and Dis. [Unnumb. Pub.] 49 pp. January 31, 1944.

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The purpose of this report is to make available to cooperators the quality data from the 1943 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

#### SOURCE OF SAMPLES

The most extensive tests have been made on Eastern and Western composite samples of each of seven uniform varieties grown in plots at 18 cooperating stations. Station samples from plots grown at Madison, Wis.; St. Paul, Morris, and Crookston, Minn.; Fargo, Langdon, and Dickinson, N. Dak.; Brookings, S. Dak.; Moccasin and Havre, Mont.; and Sheridan, Wyo., were tested by the regular methods. Further tests were made on samples of new wheats grown in increase plots from late seeding (from 1942-43 Arizona increases) grown at Langdon and Dickinson, N. Dak. Similar tests were made on Eastern and Western composites of the 26 strains grown in Uniform Regional Nurseries at 16 stations. In addition, samples from North Dakota Intra-State, Montana Intra-State, and Mandan, Langdon, and Dickinson, N. Dak., and Bozeman, Mont., station nurseries were tested.

There were also included nine samples composited from samplings of carlot receipts of wheat accumulated during a 90-day period of the 1943 crop movement by the Minneapolis, Great Falls, and Spokane offices of the Grain Products Branch, Office of Distribution. These samples represent country run wheat of the hard red spring class and were graded under the provisions of the U. S. Grain Standards Act as No. 3 or better.

#### METHODS USED IN THE BAKING TESTS

Baking tests on the 1943 varietal samples were conducted by the straight dough procedure using three of the baking procedures included in testing the 1939, 1940, 1941 and 1942 samples, i.e., (No. 2) commercial, (No. 3) commercial-bromate, and (No. 6) commercial-bromate-malted wheat flour. Details of the three methods used this year with the various ingredients are shown in table 1.

The baking procedure used is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swanson dough-mixer (108 E.P.M.) with 4 pins in the head and 2 pins in the bowl). The absorption of the flour was determined by adding the proper amount of water at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands and placed in fermentation granite-ware "oatmeal" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of an inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. A proofing time of 55 minutes at 86°F. and baking time of 25 minutes at 450°F. were the same for all the samples. Two loaves of each sample were baked but since the ingredients were mixed as for one loaf the two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The basic baking method (No. 1) which has been used on all samples starting with the 1929 crop was discontinued in 1942, as it appeared to add little information not already given by the three baking methods used on the present crop. The commercial method (No. 2) was added in 1935 and in 1936 the commercial-bromate (No. 3). For a part of the samples in 1937, the basic, commercial and commercial-bromate bakes were made. In 1938 the same bakes as reported in 1937 were made and in addition the (No. 4) malt-phosphate-bromate. In 1939, the No. 4 method, which had been found to be unsatisfactory under our conditions, was replaced by the commercial-bromate-malted wheat flour (No. 6) test. The commercial-bromate-malted wheat flour (No. 6) test was first used for part of the 1938 samples and has been continued for all of the 1939, 1940, 1941, 1942 and 1943 samples. This test seems to reveal the maximum strength of the wheats shown by the larger loaf volumes. This baking formula makes provision for adequate gas production by the employment of sufficient sugar and diastatic supplements. Each year other methods were used for certain samples or varieties. The only special tests made in 1943 were on the Eastern and Western composites for the eight uniform varieties by the Minnesota and North Dakota laboratory methods, and bromate response tests on spring and winter samples from Sheridan, Wyo.



Table 1.—Baking methods used for samples of the 1943 crop

Ingredients	Baking Methods		
	No. 2	No. 3	No. 6
	Commercial	Commercial - bromate	Commercial - bromate-malted wheat flour
Flour (grams) (13.5 percent moisture basis)	100.0	100.0	100.0
Yeast (grams)	2.0	2.0	2.0
Salt (grams)	1.5	1.5	1.5
Sugar (grams)	5.0	5.0	5.0
Potassium bromate (grams)		.001	.001
Malted wheat flour (grams)			.25
Dried skimmilk (grams)	4.0	4.0	4.0
Shortening (grams)	3.0	3.0	3.0
Water absorption (percent)	Optimum	Optimum	Optimum
Mixing time (minutes)	Optimum for each variety	Optimum for each variety	Optimum for each variety
Fermentation time (minutes)	180	180	180

Fermentation periods:

1st punch after 105 minutes, and  
2d. punch after additional 50 minutes.  
Mold after additional 25 minutes.  
Proofing time - 55 minutes.  
Baked 25 minutes at 230°C.

In the following tables, loaf volumes are reported for the different methods of baking used, but only averages are given for absorption, weight, crumb color, and grain-texture of loaf. The optimum or highest volume for any method, is shown in the tables also, but the varieties are ranked in order of their average volumes for the 3 different methods. The highest ranking variety with respect to each property is indicated by underlining. Since duplicate determinations were not made in most cases, it is not possible to correctly estimate random errors. Three baking methods were used in all cases, however, and it is possible to calculate errors by considering these as replicate bakes. The standard errors so calculated are in reality the interaction of baking method x variety. A double underline is drawn in each table separating those varieties which are significantly lower (using interaction as error) than the one having the highest average volume in the test. It should be noted that interaction error is never less (within the limits of sampling error) than the true error but may be much greater, depending on whether varieties respond alike or differently to the different baking methods. Inspection of the data indicates that in some cases not all varieties responded alike to the different baking methods from which it may be inferred that the calculated errors (variety x method interaction) are in excess of the true errors. This is in accord with other studies in this laboratory in which true errors have been calculated and found to be in the range of 15 to 20 cc for a single determination.

All test weights were determined in the laboratory on a dockage-free basis. The protein and ash contents and water absorption are reported on a 13.5 percent moisture basis and the flour yield on a moisture-free basis.

### EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 7, for bromate response in table 8; for the U.S.D.A. regular methods, U.S.D.A. modified No. 6 with phosphate, Minnesota and North Dakota methods in table 9. The results for the commercial samples are shown in table 10. Summaries of the comparable 1943 samples are averaged in table 11 and five years' results in table 12. These tables are largely self-explanatory.

Acre yields are included, where comparable, to assist in the interpretation of results. The test weights for most of the composite and station samples were satisfactory. The baking methods, Nos. 2, 3, and 6, were used as in previous years for the bulk of the composite and station samples. The milling and chemical data in table 2 are not repeated for the other baking methods reported in table 9.

### Plot Samples





Table 2.--(Continued)

Variety or Cross	C. I. No.	Acre yield		Test weight (Lbs.)	Protein content		Flour		Water absorption average	Mixing time (Min.)	Baking method and loaf volume 1/				Average		
		Region	Composite		Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti-mum	Aver-age	Weight of loaf	Crumb color and texture
Average of Eastern and Western Composites																	
Pilot	11945	27.6	25.4	58.0	15.1	14.4	63.5	.54	65	2.3	814	871	886	886	857	149	87
Thatcher	10003	26.4	25.3	58.0	15.0	14.6	61.6	.56	66	2.3	762	845	890	890	832	151	84
Rival	11708	24.5	23.7	58.5	15.3	14.4	70.8	.60	67	2.3	759	818	880	880	819	152	85
Regent	12070	22.5	23.2	58.1	15.6	14.9	70.8	.53	64	2.0	698	792	874	874	788	150	77
Cadet	12053	24.1	23.3	57.2	15.5	14.8	68.6	.60	69	2.5	660	761	887	887	769	154	80
Average	25.0	24.2		58.0	15.3	14.6	67.1	.57	66	2.3	739	817	883	883	813	151	83
Range	5.1	2.2		1.3	.6	.5	9.2	.07	5	.5	157	110	16	16	88	5	7
1/ Standard error (variety x method interaction) for a single determination = 29 cc. Significant difference = 67 cc.																	
Average 6 years 1938 to 1943, inclusive																	
Pilot	11945	26.0	25.8	57.3	15.6	14.7	68.8	.55	64		862	918	940	943	907	149	86
Thatcher	10003	24.4	24.4	57.1	15.5	15.0	69.1	.56	65		826	902	937	937	888	150	85
Ceres 2/	6900	22.3	21.4	57.8	15.4	14.9	68.5	.55	65		832	875	914	918	874	150	85
Rival	11708	24.8	24.9	58.0	15.4	14.6	71.6	.58	66		794	866	908	908	856	150	88
Marquis 3/	3641	19.2	18.7	55.9	15.0	14.3	66.9	.59	62		793	865	896	903	851	149	86
Average	23.3	23.0		57.2	15.4	14.7	69.0	.57	64		821	884	919	922	875	150	86
Range	6.8	7.1		2.1	.5	.7	4.7	.04	4		69	53	44	40	56	1	3

1/ Standard error (variety x method interaction) for a single determination = 9 cc. Significant difference = 22 cc.

2/ Results from the western composite only for 1942 and 1943.

3/ Results from the western composite only for 1943.





Table 3.---(Continued.)

Crookston, Minn.

Variety or Cross	State or Nursery number	C. I. number	Acres yield	Test weight	Protein content		Flour		Water absorption average	Baking method and loaf volume 1/				Average	
										No. 2	No. 3	No. 6	Optimum	Average	Weight of loaf
					(Pct.)	(Pct.)	(Pct.)	(Pct.)							
Pilot		11945	33.4	59.0	13.9	13.1	71.6	.47	60	(Ct.)	(Ct.)	(Ct.)	(Ct.)	(Grams)	(Score)
Newthatch	Minn. 2752	12318	37.6	59.1	14.3	14.0	75.1	.49	63	827	888	953	953	889	92
Thatcher		10003	34.1	58.5	14.1	13.6	72.8	.52	62	677	862	934	934	824	73
Fival		11708	37.5	58.0	14.8	14.4	74.3	.59	60	666	847	905	905	806	75
Wida	Ns. 2829	12008	35.0	62.6	14.0	13.7	75.4	.49	60	690	801	894	894	795	80
Renown		11947	31.0	58.1	14.7	14.2	74.1	.59	60	663	792	879	879	778	95
Henry	Wis. 233	12265	40.5	61.0	13.0	12.0	73.6	.50	60	612	763	871	871	749	73
Cadet	N.N. 1597	12053	33.7	55.8	14.6	14.2	73.5	.63	64	612	749	859	859	740	70
Regent		12070	35.2	59.6	12.9	12.2	74.4	.54	60	594	764	850	850	736	82
Rel.-Hope-Comet-1121		12050	31.9	59.1	13.9	12.6	74.4	.56	60	594	738	824	824	719	70
										603	715	804	804	707	68

Average

Range

Average

Range

1/ Standard error (variety x method interaction) for a single determination = 24 cc. Significant difference = 51 cc.

Morris, Minn.

Newthatch	Minn. 2752	12318	26.9	55.8	16.4	15.7	72.8	.67	62	815	916	989	989	907	145	87	88
Rival		11708	26.3	58.3	15.2	14.4	73.3	.69	65	795	871	916	916	861	150	88	92
Pilot	1098-13	11945	26.8	57.7	14.8	14.0	72.8	.64	60	781	868	903	903	851	145	87	90
Renown		11947	22.5	58.7	16.0	14.9	73.3	.61	60	755	853	942	942	850	146	87	87
Thatcher		10003	26.1	57.3	14.1	13.3	73.0	.60	62	772	856	908	908	845	147	90	90
Regent		12070	23.8	57.5	16.4	15.6	72.7	.62	60	717	833	936	936	829	145	87	80
Cadet	1597	12053	21.6	57.0	15.5	14.6	72.7	.65	65	698	839	900	900	812	150	88	87
Wida		12008	23.2	59.4	16.5	15.3	73.4	.59	63	717	818	850	850	795	149	88	85
Henry	Wis. 233	12265	23.6	57.6	15.9	12.3	74.5	.55	60	695	786	830	830	770	147	83	85
Rel.-Hope x Comet-1121	N.No. 1520	12050	28.0	59.5	14.9	14.1	73.8	.59	60	649	738	818	818	735	148	82	80
Average			24.7	57.9	15.4	14.4	73.2	.62	62	739	838	899	899	826	147	87	86
Range			7.5	2.5	2.6	3.4	1.8	.14	5	166	178	171	171	172	5	8	12

Standard error (variety x method interaction) for a single determination = 19 cc. Significant difference = 40 cc.

Table 3.--(Continued)

Targo, N. Dak.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume 1/				Average weight of loaf	Crumb color	Grain and texture	
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Average				
(Bu.) (Lbs.) (Pct.) (Pot.) (Pct.) (Pct.) (Min.) (Cc.) (Cc.) (Cc.) (Cc.) (Grams) (Score) (Score) (Score)																		
Herit x Thatcher	1682	12203	14.2	57.4	15.1	14.9	70.0	63	64	2.5	721	903	922	922	849	150	88	90
Adet	1597	12053	14.7	57.4	15.5	15.3	70.6	65	64	2.5	712	885	882	885	826	150	87	88
Pilot	1098-13	11945	19.3	59.0	14.2	13.6	70.6	59	60	2.0	709	861	896	896	822	148	90	90
Butcher		10003	21.1	60.2	14.7	14.3	72.6	61	62	2.0	692	847	906	906	815	147	88	85
Rival		11708	19.9	60.8	14.8	14.4	73.4	69	63	2.0	701	836	885	885	807	150	92	88
Peres		6900	17.2	60.8	13.7	13.5	71.4	59	62	2.0	723	798	865	865	795	149	87	85
Fewthatch	Minn. 2752	12318	18.6	58.8	15.4	15.2	73.0	64	62	2.0	666	806	899	899	790	150	77	83
Del.-Hope x Comet-1121	1520	12050	17.3	61.1	13.9	13.5	73.4	55	60	2.0	683	812	839	839	778	149	82	82
Regent		12070	18.9	60.5	16.0	15.8	71.7	61	60	2.0	649	827	842	842	773	149	82	82
Pilot x Mida	1756	12303	19.5	62.4	13.7	13.4	71.5	53	60	2.0	666	801	830	830	766	148	88	88
Known		11947	21.2	61.5	15.3	15.1	73.4	60	60	2.0	626	783	865	865	758	150	78	83
Mida	Ns. 2829	12008	24.0	61.6	15.3	14.6	73.6	61	60	2.0	640	786	824	824	750	148	90	87
Festa		11712	20.7	61.3	14.2	14.0	74.1	60	62	2.0	637	749	833	833	740	150	92	87
Peres-D.C. x Mercury	Ns. 2855	12335	21.2	61.8	14.0	13.6	74.7	59	62	2.0	662	761	792	792	738	152	87	85
Peres-D.C. x Mercury	Ns. 3110	12313	21.5	59.7	14.3	13.7	73.1	35	64	2.5	612	767	833	833	737	151	82	87
Peres-D.C. x Mercury	Ns. 3122	12314	21.4	59.4	14.7	14.0	72.8	57	63	2.5	618	758	815	815	730	151	85	83
Peres-D.C. x Mercury	Ns. 3121	12334	21.4	60.7	15.1	14.2	74.3	59	62	2.0	632	744	784	784	720	151	85	83
Peres x Pilot	1556	12263	18.6	60.6	14.1	13.4	71.2	56	60	2.0	607	723	763	763	698	150	87	80
Peres-D.C. x Mercury	Ns. 3103	12312	20.5	59.0	14.2	13.9	72.9	69	60	2.0	603	678	743	743	675	150	68	73
Peres x Pilot	1552	12077	18.3	59.5	13.4	12.9	71.7	61	60	1.5	596	637	710	710	648	150	68	73
Average			19.5	60.2	14.6	14.2	72.5	60	61.5	2.1	658	788	836	836	761	150	84	84
Range			9.6	5.0	2.6	2.9	4.7	34	4.0	1.0	127	266	212	212	201	5	24	17

1/ Standard error (variety x method interaction) for a single determination = 27 cc. Significant difference = 55 cc.





Table 3.--(Continued)

Dickinson, N. Dak.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Water absorption average	Mixing time	Baking method and loaf volume				Average	
					Wheat	Flour			No. 2	No. 3	No. 6	Optimum	Average	Weight of loaf
			(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)
Ceres		6900	20.7	62.2	15.2	14.7	73.6	.44	60	2.0	755	801	909	822
Mada	Ns. 2829	12008	19.6	63.7	15.3	14.6	75.1	.52	63.	2.0	717	836	868	807
Rival		11708	14.7	62.2	14.2	13.6	73.9	.61	64	2.0	761	775	856	797
Pilot	1098-13	11945	21.9	62.1	13.0	12.0	72.8	.55	62.	1.5	761	769	801	777
Ceres-D.C. x Mercury	3110	12313	19.9	62.9	14.1	13.5	74.7	.58	65	2.0	741	712	818	757
Ceres-D.C. x Mercury	3103	12312	20.6	62.7	14.2	13.5	73.9	.51	62	1.5	684	744	806	745
Comet-Pilot x Comet-1121	1689	12262	20.9	62.6	14.1	13.4	73.5	.53	63	2.0	688	738	801	742
Mada x Pilot	1756	12303	19.3	64.5	12.9	12.1	74.1	.57	60	1.5	704	738	778	740
Newthatch	Min. 2752	12318	19.4	61.9	13.0	12.7	75.1	.60	63	2.0	649	747	809	735
Vesta	Ns. 2592	11712	18.2	62.5	13.7	13.1	76.8	.63	61	2.0	652	758	789	733
Regent		12070	19.2	62.9	14.1	13.8	74.1	.60	64	2.0	623	721	810	718
Rel.-Hope x Comet-1121	1520	12050	21.8	64.1	12.6	11.9	75.1	.50	62	1.5	657	726	761	715
Thatcher		10003	21.5	62.6	12.7	12.4	74.5	.47	62	2.0	657	692	783	711
Cadet	1597	12053	20.6	62.2	13.3	12.9	74.0	.62	63	2.0	588	689	801	693
Ceres x Pilot	1552	12077	18.4	62.5	12.6	12.0	72.9	.59	63	1.5	629	691	747	689
Ceres-D.C. x Mercury	2975	12300	19.4	63.0	13.7	12.8	75.2	.57	64	1.5	618	695	732	682
Ceres x Pilot	1556	12263	17.4	62.3	13.9	13.0	72.7	.54	62	1.5	626	686	732	681
Marquis		3641	16.3	60.4	11.0	10.4	71.9	.59	60	2.0	615	649	697	654
Ceres x Hope-Ridit	1534	12039	21.1	62.3	13.4	12.4	73.9	.58	63	2.0	657	618	686	654
Hope x Turkey-Florence	1563	12195	20.5	62.3	12.1	11.6	75.6	.55	60	2.0	559	547	612	573
Average			19.6	62.6	13.5	12.8	74.2	.56	62.3	1.8	667	717	780	721
Range			7.2	4.1	4.3	4.3	4.9	.19	5.0	.5	202	289	297	249
														6
														20
														25

1/ Standard error (variety x method interaction) for a single determination = 20 cc. Significant difference = 45 cc.



Table 3.--(Continued)

Brookings, S. Dak.

Variety or cross.	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume				Average		
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Optimum	Average	Weight of loaf	Crumb color
			(Bu.)	(Lbs.)	(Pot.)	(Pot.)	(Pot.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)	(Score)
Thatcher		10003	19.6	54.4	15.0	14.3	70.3	.66	60	2.0	888	925	928	928	91.4	85	85
Ceres		6900	13.5	47.7	15.7	14.8	70.2	.69	60	2.0	862	911	925	925	899	145	63
Renown		11947	16.1	55.6	16.6	14.1	70.7	.64	60	2.0	800	922	901	922	874	144	85
Henry	Wis. 233	12265	25.1	55.0	15.2	14.3	72.7	.56	60	2.0	784	903	917	917	868	146	80
Rival x Thatcher	S.D. 2259	12272	24.5	54.3	16.2	15.0	73.6	.60	60	2.0	812	879	908	908	866	144	87
Rival x Thatcher	S.D. 2280	12273	22.7	56.1	15.9	15.5	72.6	.63	60	2.0	812	876	903	903	864	144	87
Rival x Thatcher	S.D. 2403	12299	23.0	56.2	16.2	15.6	71.4	.66	60	2.0	850	847	894	894	864	144	85
Rival x Thatcher	S.D. 2266	12342	24.5	55.7	15.6	15.0	72.3	.61	60	2.0	842	868	882	882	864	145	85
Rival		11708	21.1	55.1	15.2	14.3	72.4	.64	60	2.0	809	859	842	859	837	145	85
Newthatch	Minn. 2752	12318	19.0	52.1	16.9	16.5	70.7	.72	60	2.0	772	888	833	888	831	146	78
Pilot		11945	22.0	54.3	16.3	15.5	69.9	.66	60	1.5	743	839	888	888	823	145	83
Regent		12070	17.1	54.5	16.5	15.9	70.9	.62	60	2.0	786	850	821	850	819	145	80
Cadet	1597	12053	19.9	53.7	16.3	16.0	70.6	.64	62	2.0	718	818	859	859	798	148	77
Mida	Ns. 2829	12008	22.5	57.8	16.2	16.0	73.9	.64	60	1.5	744	781	821	821	782	146	80
Rel.-Hope x Comet-1121	1520	12050	21.5	54.8	15.1	14.4	72.2	.59	60	1.5	720	692	749	749	720	147	72
Average			20.8	54.5	15.9	15.1	71.6	.64	60.1	1.9	796	857	871	886	842	145	82
Range			11.6	10.1	1.9	2.4	4.0	.16	2.0	.5	170	233	179	179	194	5	17

1/ Standard error (variety x method interaction) for a single determination = 28 cc. Significant difference = 57 cc.

Table 3.---(Continued)

Moccasin, Mont.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume 1/				Average weight of loaf	Grain and texture
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Optimum		
			(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)
Pilot	1098-13	11945	23.4	59.5	16.6	16.2	72.4	.43	62	2.0	898	974	1036	1036	147	88
Comet x Pilot	1585	12073	24.6	59.6	17.5	16.9	72.2	.49	64	2.0	883	922	1001	1001	148	80
Ceres		6900	24.1	61.9	16.5	16.2	73.4	.45	63	2.0	827	870	977	977	149	88
Thatcher		10003	23.6	58.8	16.8	16.4	72.9	.45	64	2.0	745	868	971	971	149	83
Marquis		3641	21.1	61.0	17.2	17.0	72.6	.52	60	2.0	723	853	923	923	148	90
Comet x N. 1110	1466-2	11931	23.8	61.8	16.9	16.3	73.8	.48	63	2.0	674	851	871	871	150	83
Comet x N. 1018	1315	12060	25.4	60.0	16.2	15.5	71.2	.43	62	2.0	717	812	851	851	149	92
Rival		11708	19.9	60.4	15.9	15.4	73.9	.55	64	2.0	665	783	879	879	152	85
Newthatch	Minn. 2752	12318	21.6	57.4	17.3	15.6	72.8	.48	60	2.0	715	761	833	833	148	88
Regent		12070	24.2	59.2	17.2	16.6	72.3	.42	62	2.0	698	744	842	842	151	77
Vesta		11712	21.2	60.4	17.0	16.1	74.6	.54	63	2.0	631	764	871	871	151	85
Cadet	1597	12053	21.5	59.5	17.8	17.2	72.8	.55	65	2.0	649	749	845	845	152	82
Rel.-Hope x Comet-1121	1520-1	12343	24.4	60.2	17.3	16.8	71.7	.44	61	1.5	657	763	812	812	149	75
Rel.-Hope x Comet-N. 1121	1520	12050	20.2	61.0	17.4	16.5	72.6	.48	61	1.5	671	710	778	778	149	80
Merit	1348-3	12036	23.5	59.1	17.0	16.7	74.7	.49	64	2.0	598	747	798	798	152	78
Average			22.8	60.0	17.0	16.4	72.9	.48	63	1.9	717	811	886	886	150	83
Range			5.5	3.1	1.9	1.8	3.5	.13	5	.5	300	264	258	258	5	15

1/ Standard error (variety x method interaction) for a single determination = 31 cc. Significant difference = 64 cc.



Table 3.--(Continued)

Havre, Mont.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein Content		Flour		Water absorption average	Mixing time	Baking method and loaf volume 1/				Average		
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti-mum	Weight of loaf	Crumb color	Grain and texture
Ceres		6900	32.2	(Lbs.) 57.1	(Pot.) 16.8	(Pot.) 16.5	(Pot.) 71.8	(Pot.) .47	(Pct.) 64	(Min.) 2.5	(Cc.) 735	(Cc.) 898	(Cc.) 971	(Cc.) 971	(Grams) 150	(Score) 82	(Score) 83
Thatcher		10003	37.0	55.0	17.7	17.5	70.5	.44	62	2.0	728	856	992	992	150	82	78
Rival		11708	29.4	54.7	16.5	15.8	71.2	.54	64	2.5	715	865	992	992	151	87	82
Regent		12070	36.1	56.1	17.1	16.9	71.2	.47	64	2.0	707	901	953	953	151	78	80
Marquis		3641	29.7	55.9	17.4	16.5	70.1	.49	62	2.0	707	859	923	923	149	87	78
Pilot		11945	28.1	53.2	17.9	17.5	68.9	.51	63	2.0	717	845	925	925	151	75	77
Newthatch	Minn. 2752	12328	35.8	55.5	17.7	17.4	72.0	.52	64	2.0	695	729	911	911	152	78	80
Bel.-Hope x Comet-1121	1520	12050	31.1	55.0	17.3	16.2	71.4	.47	60	2.0	652	755	824	824	150	73	77
Cadet	1597	12053	32.5	54.4	17.8	17.2	70.5	.53	65	2.0	621	741	815	815	153	78	72
Average			32.4	55.2	17.4	16.8	70.8	.49	63	2.1	698	828	923	923	151	80	79
Range			7.6	3.9	1.4	1.7	3.1	.10	5	.5	114	172	177	177	4	14	11

1/ Standard error (variety x method interaction) for a single determination = 29 cc. Significant difference = 61 cc.

Table 3.--(Continued)

Sheridan, Wyo.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume			Average			
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Optimum	Average	Weight of loaf	Crumb texture
(Bu.) (Lbs.) (Pct.) (Pct.) (Pct.) (Pct.) (Pct.) (Pct.) (Pct.) (Min.) (Cc.) (Cc.) (Cc.) (Cc.) (Grams) (Score) (Score)																	
Marquis		3641	31.5	59.3	16.2	15.3	72.0	.56	61	2.0	812	862	916	916	146	93	87
Pilot		11945	40.7	58.4	15.4	14.0	71.0	.48	60	2.0	818	818	934	934	144	93	92
Merit x Thatcher	1682	12203	36.1	56.1	15.8	15.3	72.1	.56	62	2.0	709	821	910	910	147	87	90
Ceres		6900	36.4	59.6	15.8	15.3	71.7	.54	64	2.0	798	778	830	830	148	78	88
Rival		11708	32.4	58.5	15.4	14.7	73.4	.57	63	2.0	720	801	883	883	148	87	85
C.-P. x C.R.H.	1689	12262	37.9	58.0	15.7	15.2	71.9	.52	62	2.0	720	795	839	839	147	95	90
Comet-1110 x H-44-Ceres	1596	12052	37.6	58.2	15.5	14.9	72.9	.55	62	2.0	674	787	873	873	147	75	88
Cadot	1597	12053	39.1	57.2	15.8	15.1	72.8	.55	63	2.0	665	792	870	870	148	87	85
Mida	Ms.2829	12008	39.7	60.7	15.9	15.3	73.4	.45	60	2.0	738	752	836	836	147	92	93
Comet-1110 x H-44-Ceres	1586	12276	35.5	59.5	14.8	13.9	73.7	.44	60	1.5	704	769	839	839	146	77	78
Comet x Pilot	1540-2	12274	37.3	59.4	15.9	15.3	71.3	.51	60	1.5	715	786	812	812	146	73	90
Comet x Pilot	1585	12073	41.9	59.1	15.3	14.5	71.7	.45	60	2.0	781	726	801	801	146	75	88
Comet x 1110	1466	11931	37.3	60.5	15.1	14.4	73.0	.50	60	2.0	712	758	827	827	147	78	87
Rel.-Hope x Comet-1121	1520	12050	36.7	58.9	15.5	14.9	73.0	.45	60	1.5	648	735	815	815	147	80	88
Thatcher		10003	38.8	58.7	15.9	15.4	72.5	.52	60	2.0	655	738	784	784	146	80	78
Hope x Thatcher <sup>3</sup>	II-31-14	12044	37.0	58.0	16.3	15.8	73.0	.56	62	1.5	626	715	775	775	149	67	77
Regent		12070	36.1	58.9	16.1	15.8	72.1	.52	60	2.0	668	701	746	746	147	72	80
Newthatch	Minn.2752	12328	29.9	58.0	16.4	15.8	72.6	.58	62	1.5	649	709	750	750	149	75	75
Merit x Pilot	1652	12275	44.9	59.3	15.9	15.5	70.7	.54	63	2.0	615	655	772	772	150	75	80
Comot x 1121	1584	12258	41.0	59.4	15.0	13.9	71.7	.48	60	1.5	629	655	750	750	147	72	80
Average			37.4	58.8	15.7	15.0	72.3	.52	61	1.9	703	758	828	828	147	81	85
Range			15.0	4.6	1.6	1.9	3.0	.14	4	.5	203	207	188	188	6	28	18

1/ Standard error (variety x method interaction) for a single determination = 28 cc. Significant difference = 56 cc.



Table 4.--Yield, milling, baking and chemical results on new hybrid spring wheats grown in small increase plots from late seeding (Arizona increases) at two stations in 1943

Langdon, N. Dak.

Variety or cross	Nursery number	C. I. Acre number yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume				Average				
				Theat Flour		Yield	Ash			No. 2	No. 3	No. 6	Optimum	Average	Weight of loaf	Crumb and color texture		
N. 1441 x Renown	1833	12361	30.8	61.6	14.4	13.9	72.9	.42	64	2.0	621	786	836	836	748	152	85	80
Rel.-Hope x H-44-Ceres	1797		25.4	61.2	14.5	14.3	73.9	.49	63	2.0	626	743	798	798	722	151	83	80
Pilot x Merit	1827	12352	28.5	60.0	14.2	14.0	72.0	.49	65	2.0	604	738	792	792	711	154	77	77
Pilot x N. 1315	1829	12353	30.5	60.1	14.8	14.4	73.2	.46	62	2.0	576	738	783	783	699	150	82	77
Pilot x Mida	1750	12316	34.8	63.7	14.5	14.3	73.6	.44	60	2.0	592	709	783	783	695	149	87	78
Merit x Pilot	1764	12315	29.1	60.5	14.7	13.8	72.5	.50	65	2.0	567	704	801	801	691	153	77	72
Pilot x Mida	1826		27.4	62.4	15.4	15.0	73.2	.44	60	1.5	629	657	786	787	691	150	85	78
Merit x Pilot	1792	12362	28.5	60.9	15.1	14.8	72.8	.42	65	2.0	606	673	772	772	684	154	78	75
N. 1441 x N. 1508	1703	12319	32.5	59.6	13.5	12.9	72.8	.37	62	2.0	573	709	761	761	681	151	72	78
Mida x Cadet	1831	12363	28.8	61.4	14.3	14.0	73.7	.43	64	2.0	583	686	766	766	678	153	78	75
Merit -3	(Check)	12036	28.5	59.1	14.7	14.4	74.7	.50	62	2.0	553	674	800	800	676	150	75	73
Merit x Pilot	1830	12364	26.8	60.2	14.7	14.5	73.1	.49	66	2.0	598	668	726	726	664	154	77	75
N. 1441 x Renown	1832		25.7	59.6	15.1	14.9	72.5	.50	60	1.5	600	652	723	723	658	151	70	70
Rel.-Hope x H-44-Ceres	1706		24.5	60.3	14.8	14.2	73.5	.49	62	2.0	558	654	741	741	651	151	72	75
Mida x Cadet	1835		32.2	61.0	14.1	13.7	73.1	.48	60	2.0	564	663	720	720	649	150	85	75
Pilot x Mida	1785		30.8	61.2	14.4	14.3	73.6	.48	60	1.5	556	631	707	707	631	152	82	70
Average			29.1	60.8	14.6	14.2	73.2	.46	63	1.9	587	693	768	768	683	152	79	76
Range			10.3	4.6	1.9	2.1	1.9	.13	5	.5	76	155	129	129	117	5	15	10

1/ Standard error (variety x method interaction) for a single determination = 24 cc. Significant difference = 49 cc.

Table 4.---(Continued)

Dickinson, N. Dak.

Variety or cross	Nursery number	Acre yield	Test weight	Protein Content		Flour		Water absorption average	Mixing time	Baking method and loaf volume I/				Average			
				Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti- mum.	Aver- age.	Weight of loaf	Crumb color	Grain and texture
		(Bu.)	(lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)	(Score)
Thatcher	(Check)	23.0	61.4	15.2	15.1	71.4	.42	60	2.0	821	868	968	968	886	147	92	88
Regent x Mida	1844	24.0	62.7	15.1	14.4	73.3	.45	62	2.0	781	913	942	942	879	148	85	90
Pilot	(Check)	22.7	60.8	14.4	14.0	71.7	.43	60	2.0	842	862	913	913	872	147	92	87
N. 1556 x N. 1563	1840	21.1	61.1	15.3	14.7	72.0	.40	60	1.5	809	868	928	928	868	146	90	88
N. 1556 x N. 1563	1839	21.1	61.3	15.0	13.7	72.5	.43	60	1.5	792	821	905	905	839	148	92	90
N. 1556 x N. 1563	1841	20.4	61.8	15.5	15.2	71.9	.38	60	1.5	729	803	873	873	802	147	87	87
Regent x Mida	1843	25.3	62.3	16.4	16.1	73.0	.45	60	2.0	683	798	868	868	783	148	83	83
Regent x Mida	1842	22.7	61.3	15.0	14.7	73.9	.48	60	2.0	649	741	795	795	728	148	83	83
Average		22.5	61.6	15.2	14.7	72.5	.43	60.3	1.8	763	834	899	899	832	147	88	87
Range		4.9	1.9	2.0	2.4	2.5	.10	3.0	.5	193	172	173	173	158	2	9	7

1/ Standard error (variety x method interaction) for a single determination = 23 cc. Significant difference = 50 cc.



# Nursery Samples

Table 5.--Yield, milling, baking and chemical results on 26 wheats grown in the Uniform Regional Nursery for Eastern Composite, Western Composite, and average of Eastern and Western Composites in 1943

## Eastern Composite

Variety or cross	Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume				Weight of loaf	Average	
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti-mum		Crumb color	Grain and texture
			(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)	(Score)
Regent x Pilot	1753	12317	22.4	58.1	15.9	15.1	70.9	.61	65	2.5	792	953	998	998	149	85	83
Merit x Pilot	1764	12315	27.9	58.4	15.6	14.8	70.8	.58	65	2.0	800	886	974	974	150	88	88
Rival x Thatcher	S.D. 2280	12273	26.0	59.0	15.7	15.0	73.8	.55	63	2.5	722	912	984	984	148	87	87
Merit x Thatcher	1632	12280	22.6	58.1	15.8	15.0	71.3	.62	65	2.5	812	872	928	928	150	85	87
H-44-Marquis x Thatcher	II-36-1	12304	27.2	58.3	15.7	14.9	72.6	.57	62	2.0	806	877	925	925	147	87	90
Thatcher		10003	22.1	57.0	15.1	14.7	72.7	.61	60	2.0	755	901	948	948	147	80	85
C.H.F. x Thatcher	II-36-17	12306	25.7	58.0	15.2	14.1	75.0	.57	66	2.5	769	876	939	939	152	92	92
Rival x Thatcher	S.D. 2259	12272	28.3	58.6	15.8	14.9	73.9	.60	64	2.5	732	893	954	954	150	82	87
H-44-Marquis x Thatcher	II-36-13	12309	26.0	58.9	15.2	14.3	72.7	.54	64	2.0	741	879	957	957	150	82	83
Ceres-D.C. x Mercury	Ns. 3122	12314	23.6	57.1	15.9	15.4	72.4	.60	66	2.5	717	885	959	959	152	80	88
Hope x Thatcher	II-36-35	12268	26.0	58.5	16.6	16.4	72.0	.59	62	2.0	744	894	917	917	149	83	83
Reward-Hope x Comet-Pilot	1526	12325	21.3	59.7	15.6	15.2	71.8	.58	63	2.5	683	903	957	957	149	78	83
Ceres-D.C. x Mercury	Ns. 3110	12313	25.7	57.4	15.5	15.2	73.1	.64	65	2.5	732	876	922	922	151	90	87
H-44 x Ceres-Komar-Ridit	1613	12305	23.7	59.5	15.3	15.0	73.7	.57	62	2.5	701	871	928	928	149	88	83
Comet x Pilot	1540-2	12274	23.6	58.8	15.4	14.9	72.2	.60	63	2.0	668	856	922	922	148	75	83
Marquis		3641	15.6	55.4	14.2	13.4	70.0	.56	60	2.0	750	844	833	844	147	82	85
Ceres-D.C. x Mercury	Ns. 3103	12312	24.2	57.0	15.9	15.2	73.7	.56	62	2.0	698	827	885	885	149	82	87
Ceres-D.C. x Mercury	Ns. 2848	12311	24.4	59.0	15.3	14.4	73.3	.57	62	2.0	683	827	892	892	148	90	88
Henry	Wis. 233	12265	28.8	59.1	14.4	13.9	74.8	.54	62	2.0	704	798	862	862	151	70	75
Pilot x Mida	1756	12303	25.7	60.9	15.8	14.9	73.1	.57	60	2.0	709	789	847	847	148	90	87
H-44 x Marquis 2	R.L. 1527	12302	22.6	57.7	15.2	15.0	72.2	.59	60	2.0	683	812	842	842	148	73	83
Rel.-Hope x Comet-1121	1520	12050	25.9	59.1	15.1	14.1	73.8	.55	60	2.0	709	780	845	845	146	77	85
Mercury 2 x Comet-1018	Ns. 2822-6	12310	24.4	57.2	15.8	15.1	72.9	.57	66	2.0	686	789	836	836	154	75	78
C.H.F. x Thatcher	II-36-24	12307	27.0	58.0	15.4	14.3	74.5	.55	61	2.0	651	786	868	868	150	82	83
Pilot x Mida	1750	12316	26.3	61.2	15.5	14.9	72.5	.59	60	2.0	660	755	827	827	148	88	85
Ceres x Pilot	1556	12263	26.2	58.4	15.5	15.0	72.6	.62	62	2.0	660	726	803	803	152	67	73

Average  
Range

24.5 58.4 15.5 14.8 72.8 .58 62.8 2.2 722 849 906 906 825 149 82 85  
13.2 5.8 2.4 3.0 5.0 .10 6.0 .5 152 227 171 171 184 8 25 19

1/ Standard error (variety x method interaction) for a single determination = 28 cc. Significant difference = 55 cc.

Table 5.--(Continued.)

## Western Composite

Variety or cross	State or Nursery number	C. I. Acre number	Test weight	Protein content		Flour		Water absorption average	Baking method and loaf volume				Average	
				Wheat	Flour	Yield	Ash		No. 2	No. 3	No. 6	Optimum	Weight of loaf	Crumb color and texture
			(Bu.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Ct.)	(Ct.)	(Ct.)	(Ct.)	(Grams)	(Score)
Thatcher		10003	23.2	54.7	16.9	16.4	70.2	.47	879	1041	1067	1067	996	77
Regent x Pilot	1753	12317	21.9	56.8	17.0	16.6	68.3	.52	795	1001	1064	1064	953	83
Rival x Thatcher	S.D. 2280	12273	23.3	57.0	16.5	15.8	70.5	.45	807	1024	1015	1024	949	83
Marquis		3641	18.4	57.3	16.2	15.8	69.4	.51	871	977	983	983	944	83
Rival x Thatcher	S.D. 2259	12272	22.5	56.4	16.2	15.5	70.4	.45	830	980	1015	1015	942	83
Reward-Hope x Comet-Pilot	1526	12325	18.4 <sup>2</sup>	57.3	16.9	16.3	68.2	.51	795	974	1050	1050	940	85
Comet x Pilot	1540-2	12274	19.4	57.0	17.2	16.9	69.4	.50	851	951	959	959	920	80
H-44 x Marquis	R.L. 1527	12302	21.3	55.8	16.3	15.7	69.7	.51	781	951	1015	1015	916	77
H-44-Marquis x Thatcher	II-36-1	12304	22.4	55.5	16.2	16.0	70.8	.47	806	942	953	953	900	85
Merit x Pilot	N. 1764	12315	23.0	55.5	16.9	16.5	67.7	.60	741	937	962	962	880	85
Ceres-D.C. x Mercury	Ns. 3122	12314	19.4	56.6	17.3	16.4	70.8	.50	726	928	971	971	875	85
Ceres-D.C. x Mercury	Ns. 3110	12313	20.8	57.1	16.2	15.9	70.5	.60	746	943	931	943	943	88
Ceres-D.C. x Mercury	Ns. 2848	12311	23.5	58.1	16.0	15.8	71.1	.47	750	911	948	948	870	85
H-44 x Ceres-Komar-Ridit	1613	12305	20.9	57.3	16.1	15.9	71.5	.50	738	934	934	934	869	80
Ceres-D.C. x Mercury	Ns. 3103	12312	20.2	56.0	16.6	16.5	72.0	.51	747	923	928	928	866	85
Merit x Thatcher	1632	12280	19.7	55.9	17.6	17.4	69.3	.55	735	868	968	968	857	78
C.H.F. x Thatcher	II-36-17	12306	20.5	55.8	15.5	14.5	71.7	.51	752	874	936	936	854	88
Pilot x Mida	1756	12303	23.4	59.5	15.7	15.3	70.2	.47	786	865	891	891	847	87
H-44-Marquis x Thatcher	II-36-13	12309	23.7	56.7	16.2	15.8	69.1	.45	668	908	951	951	842	80
Hope x Thatcher	II-36-35	12368	22.2	56.7	17.5	17.3	70.7	.49	668	865	931	931	821	80
Henry	Wis. 233	12265	23.5	56.5	15.6	15.2	72.3	.46	698	851	885	885	811	82
Rel.-Hope x Comet-1121	1520	12050	20.9	57.3	16.9	16.4	70.4	.48	698	830	859	859	796	78
C.H.F. x Thatcher	II-36-24	12307	21.9	56.3	15.2	14.0	71.8	.52	690	824	848	848	787	87
Pilot x Mida	1750	12316	21.6	58.9	16.2	15.6	68.8	.50	729	889	839	839	786	85
Ceres x Pilot	1556	12263	24.3	56.3	16.7	16.2	68.9	.49	621	842	862	862	775	78
Mercury 2 x Comet-1018	Ns. 2822-6	12310	22.5	55.4	15.9	15.4	72.3	.49	629	824	830	830	761	80
Average		21.7	56.7	16.4	16.0	70.2	.50	61.9	2.1	751	914	946	872	83
Range		5.9	4.8	2.4	3.4	4.6	.15	5.0	.5	258	252	228	235	13

<sup>1</sup>/<sub>2</sub> Average yield at only 3 stations, not grown at Dickinson  
Standard error (variety x method interaction) for a single determination = 31 cc. Significant difference = 61 cc.



Table 5.---(Continued)

## Average of the Eastern and Western Composites

Variety or cross	State or Nursery number	C. I. no.	Acre yield	Test weight	Protein content		Flour		Water absorption average	Baking method and loaf volume			Average Crumb color	Grain and texture			
					Wheat	Flour	Yield	Ash		No. 2	No. 3	No. 6			Opti- mum	Aver- age	
(Bu.) (Lbs.) (Pct.) (Pct.) (Pct.) (Pct.) (Pct.) (Pct.) (Cc.) (Cc.) (Cc.) (Cc.) (Grams) (Score) (Score)																	
Regent x Pilot	1753	12317	22.2	58.0	16.5	15.9	69.6	.57	65	2.5	794	977	1031	934	149	84	83
Thatcher	-----	10003	22.7	55.9	16.0	15.6	71.5	.54	60	2.0	817	971	1007	932	146	79	80
Rival x Thatcher	S.D. 2280	12273	24.7	58.0	16.1	15.4	72.2	.50	63	2.5	765	968	1000	911	147	84	85
Rival x Thatcher	S.D. 2259	12272	25.4 <sub>2</sub>	57.5	16.0	15.2	72.2	.53	63	2.3	781	937	985	901	148	82	85
Reward-Hope x Comet-Pilot	1526	12325	19.9 <sub>2</sub>	58.5	16.3	15.8	70.0	.55	64	2.5	739	939	1004	894	149	78	84
H-44-Marquis x Thatcher	II-36-1	12304	24.8	56.9	16.0	15.5	71.7	.52	61	2.0	806	910	939	885	147	86	88
Morit x Pilot	1764	12315	25.5	57.0	16.3	15.7	69.3	.59	65	2.0	771	912	968	884	150	86	87
Marquis	-----	3641	17.0	56.3	15.2	14.6	69.7	.54	60	2.0	811	911	908	911	146	84	84
Comet x Pilot	1540-2	12274	21.5	57.9	16.3	15.9	70.8	.55	63	2.0	760	904	941	868	148	76	82
Ceres-D.C. x Mercury	Ns. 3122	12314	21.5	56.9	16.6	15.9	71.6	.55	65	2.3	722	907	965	865	150	81	87
Morit x Thatcher	1632	12280	21.2	57.0	16.7	16.2	70.3	.59	65	2.5	776	870	948	865	151	82	83
C.H.F. x Thatcher	II-36-17	12306	23.1	56.9	15.4	14.3	73.4	.54	65	2.3	761	875	938	858	151	86	90
Ceres-D.C. x Mercury	Ns. 3110	12313	23.3	57.3	15.9	15.6	71.8	.62	64	2.3	739	910	927	858	150	87	88
H-44-Marquis x Thatcher	II-36-13	12309	24.9	57.8	15.7	15.1	70.9	.50	63	2.0	705	894	954	851	149	79	87
H-44 x Ceres-Komar-Ridit	1613	12305	22.3	58.4	15.7	15.5	72.6	.54	62	2.5	720	903	931	851	148	83	82
H-44 x Marquis 2	R.I. 1527	12302	22.0	56.8	15.8	15.4	71.0	.55	60	2.0	732	882	929	848	147	76	80
Hope x Thatcher 3	II-36-35	12268	24.1	57.6	17.1	16.9	71.4	.55	61	2.0	706	880	924	837	148	79	82
Ceres-D.C. x Mercury	Ns. 2848	12311	24.0	58.6	15.7	15.1	72.2	.52	62	2.0	717	869	920	835	148	88	88
Ceres-D.C. x Mercury	Ns. 3103	12312	22.2	56.5	16.3	15.9	72.9	.54	61	2.0	723	875	907	835	148	83	87
Pilot x Mida	1756	12303	24.6	60.2	15.8	15.1	71.7	.52	60	2.0	748	827	869	815	147	89	87
Henry	Wis. 233	12265	26.2	57.8	15.0	14.6	73.6	.50	61	2.0	701	825	874	800	150	69	79
Rel.-Hope x Comet-1121	1520	12050	23.4	58.2	16.0	15.3	72.1	.52	60	2.0	704	805	852	787	146	76	82
C.H.F. x Thatcher	II-36-24	12307	24.5	57.2	15.3	14.2	73.2	.54	64	2.0	671	805	858	778	149	80	85
Pilot x Mida	1750	12316	24.0	60.1	15.9	15.3	70.7	.55	60	2.0	695	772	833	767	148	88	85
Mercury 2 x Comet-1018	Ns. 2822.6	12310	23.5	56.3	15.9	15.3	72.6	.53	65	2.0	658	807	833	766	152	72	79
Ceres x Pilot	1556	12263	25.3	57.4	16.1	15.6	70.8	.56	62	2.0	641	784	833	753	151	74	76
Average			23.2	57.6	16.0	15.4	71.5	.54	62	2.1	737	882	926	848	149	81	84
Range			9.2	4.3	2.1	2.7	4.3	.12	5	.5	176	205	198	181	6	17	14

1/ Standard error (variety x method interaction) for a single determination = 22 cc. Significant difference = 44 cc.  
 2/ Grown at only 7 of the 12 stations included in the two composites.

Table 6.---Yield, milling, baking and chemical results on hard red spring wheats grown in North Dakota and Montana. Intra-State Nurseries, composited from stations indicated, 1943 crop

Fargo-Landon-Dickinson Composite.

Variety or cross	State or Nursery number	C. I. number	Acres yield	Test weight	Protein content		Flour		Water absorption average	Baking method and loaf volume				Average	
					Wheat	Flour	Yield	Ash.		No. 2	No. 3	No. 6	Optimum	Weight of loaf	Crumb color
			(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)
H.R.R. x K.H.H.R.	D.1742		31.5	59.0	15.6	14.9	73.3	.56	65	2.0	778	871	896	848	87
Ceres-D.C. x Mercury	Ns. 2852		36.0	61.2	15.5	14.6	72.5	.46	60	2.0	764	862	875	834	93
Ceres-D.C. x Mercury	Ns. 3107		31.1	58.4	15.6	14.9	74.4	.51	60	2.0	789	833	871	831	88
Comet-1110 x H-44-Ceres	1586-2		31.3	60.4	15.0	13.5	73.0	.52	60	1.5	781	827	879	829	83
N. 1445 x Pilot	1768	12323	28.1	60.2	15.5	15.1	73.0	.51	60	1.5	712	836	922	823	87
Mida x Regent	Ns. 3117		30.2	59.5	16.3	15.5	75.7	.58	62	2.0	715	851	897	821	82
Merit x Pilot	1792		32.9	59.2	16.3	16.0	72.7	.66	67	2.0	652	856	922	810	78
Mida x N. 1574	1760	12322	32.8	61.7	16.3	16.1	73.1	.56	64	2.0	707	804	888	800	78
Mida x Cadet	1752	12321	34.3	60.6	15.9	15.7	75.3	.58	62	2.0	691	830	859	793	87
Ns. 2822 x Premier	Ns. 3120		34.2	60.2	16.5	16.0	74.7	.52	60	1.5	655	801	883	780	85
Pilot x Mida	1769	12324	37.0	61.6	15.6	15.1	73.2	.56	60	1.5	654	801	862	772	85
Mercury x Komar-Hussar	D 1736		33.4	60.6	15.3	14.8	75.1	.53	65	2.0	665	789	856	770	87
Newthatch			24.5	58.7	17.1	16.0	73.4	.60	62	1.5	683	755	862	767	77
Rel.-Hope x H-44-Ceres	1705	12320	32.1	60.1	16.0	15.6	73.9	.66	65	2.0	652	795	853	767	72
Mercury 3 x Ceres-D.C.	Ns. 3112		29.1	59.5	15.8	14.9	75.3	.55	65	2.0	646	795	850	764	82
Mercury x H-44-Ceres	Ns. 3114		32.2	59.2	16.5	15.7	74.8	.55	63	2.0	701	764	821	821	83
Mercury x H-44-Ceres	Ns. 3115		31.3	60.0	16.0	15.3	73.8	.61	66	2.0	671	772	836	760	78
Mercury x H-44-Ceres	Ns. 3116		31.5	59.0	15.2	14.6	71.0	.57	64	2.0	654	750	836	747	78
C.K.H. x Mercury	D 1726		34.0	60.0	16.1	15.3	74.6	.50	63	2.0	654	743	839	745	82
N. 1441 x N. 1508	1703	12319	35.9	60.3	14.6	14.2	73.9	.48	63	2.0	643	789	789	740	80
Pilot x Mida	1826		36.4	60.0	16.0	15.0	71.2	.55	60	1.5	640	747	824	737	75
Mida x Cadet	1777		30.4	60.0	16.0	15.8	74.0	.53	60	2.0	600	743	859	734	83
Comet x N. 1121	D 1609		37.7	60.7	15.1	14.4	74.0	.44	60	2.0	588	741	856	728	82
Mercury x Komar-Hussar	D 1800		30.3	59.0	15.6	14.7	73.3	.54	64	2.0	582	704	778	688	78
Ns. 2822 x Premier	Ns. 3119		30.9	60.0	16.3	15.6	75.7	.61	64	2.0	573	703	764	680	73
Ns. 2822 x Ns. 2809	Ns. 3118		27.3	59.0	16.4	15.8	74.1	.53	63	2.0	588	678	726	664	77
Average			32.2	59.9	15.9	15.2	73.8	.55	63	1.9	671	786	850	769	81
Range			13.2	3.3	2.1	2.6	4.7	.22	7	.5	216	153	196	184	10

1/ -Standard error (variety x method interaction) for a single determination = 28 cc. Significant difference = 57 cc.



Table 6.--(Continued)

Montana Intra-State Nursery

Moccasin-Havre Composite

Variety or cross	Nursery number	C. I. number	Acre yield (Bu.)	Test weight (Lbs.)	Protein content		Water absorption average	Mixing time	Baking method and loaf volume 1/				Average	
					Wheat	Flour			No. 3	No. 6	Optimum	Average	Weight of loaf	Grain and texture
					(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)
Pilot	(Check)	11945	24.9	56.6	16.7	16.4	50	2.0	851	992	1027	957	144	88
N. 1449 x Pilot	1855		23.8	58.0	16.7	16.4	51	2.5	752	908	1044	901	152	77
Pilot x Merit	1863		23.8	57.0	17.1	16.6	54	2.5	704	901	1015	873	154	80
Comet x Pilot	1585	12073	28.2	57.7	15.8	15.5	43	2.0	853	842	903	866	147	77
Pilot x Merit	1827	12352	26.2	57.0	16.4	15.6	59	2.5	720	900	965	862	151	80
Comet-1110 x Pilot	1676		23.4	58.8	16.5	16.2	50	2.0	781	870	906	852	149	87
Thatcher	(Check)	10003	29.0	55.9	17.3	17.1	51	2.0	701	868	983	851	149	73
Regent x Pilot	1869		22.8	56.6	16.6	16.5	57	2.0	677	855	977	840	149	77
Comet-1110 x Pilot	1850		23.6	58.0	16.1	15.6	48	2.0	766	856	897	840	150	80
Ed. 1018 x Mercury	1691		28.4	55.8	15.4	14.6	44	2.0	760	853	886	833	149	78
Comet x N. 1110	1466-2	11931	24.1	60.4	16.3	15.8	50	2.0	741	830	894	822	146	78
Pilot x Merit	1774		24.1	57.0	17.0	16.7	65	2.5	668	862	925	818	153	73
Comet x N. 1018	1315	12060	29.6	57.1	15.8	14.8	48	2.0	712	824	898	811	152	80
Rel.-Hope x H-44-Cores	1705		23.0	56.6	17.2	16.9	64	2.5	710	818	889	806	154	65
N. 1248 x Merit	1798		22.7	56.6	17.1	16.7	59	2.5	669	807	923	800	153	77
Mida x C det	1752	12321	22.9	59.1	16.1	15.8	54	2.0	665	848	876	796	151	82
Pilot x Mida	1751		24.6	59.0	15.3	15.1	51	2.0	677	818	892	796	150	75
Comet-1110 x Pilot	1663-1		24.5	59.1	16.7	16.3	50	2.0	707	803	871	794	152	73
Rel.-Hope x Comet-1121	1594-3-1		19.3	56.4	17.5	17.2	53	2.0	683	818	870	790	150	73
Mida x Cadet	1831	12363	22.7	58.5	16.5	16.3	53	2.0	672	815	866	784	152	78
N. 1441 x Renown	1861		23.3	58.9	15.8	15.2	58	2.0	675	798	853	775	150	80
Rel.-Hope x Pilot	1872		21.1	59.1	16.6	16.1	57	2.0	726	753	824	769	150	77
Rel.-Hope x Comet-1121	1520-1		21.8	57.1	17.4	16.8	49	2.0	677	772	856	763	150	73
Mida x Cadet	1786		28.3	57.4	16.2	16.2	54	2.0	715	755	824	765	155	80
Rel.-Hope x H-44-Cores	1717		21.9	57.5	17.0	16.3	60	2.5	698	741	836	758	152	68
Merit x Pilot	1830	12364	27.1	57.1	16.9	16.6	62	2.0	663	738	801	734	155	72
Merit x Pilot	1860	12355	29.5	57.1	16.8	16.4	63	2.5	663	729	787	726	154	72
Average			24.6	57.6	16.5	16.1	70.9	2.1	714	829	900	814	151	77
Range			10.3	4.6	2.2	2.6	4.5	.5	190	263	257	131	11	23

1/ Standard error (variety x method interaction) for a single determination = 35 cc. Significant difference = 70 cc.

Table 7.---Yield, milling, baking and chemical results on hard red spring wheats grown in the station nurseries at Mandan, Langdon, Dickinson, and Bozeman in 1943

Mandan, N. Dak.

Variety or cross	Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Baking method and loaf volume 1/				Average			
					Wheat	Flour	Yield	Ash		No. 2	No. 3	Opti-mum	Aver-age	Weight of loaf	Crumb and color	Grain texture	
(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)						
Comet-1121 x C.H.F.	1675		33.9	60.5	12.0	10.9	74.3	.47	60	2.0	752	671	812	745	147	87	85
Pilot x Merit	1827	12352	31.9	59.7	12.1	11.4	72.8	.58	63	2.0	696	732	798	742	150	87	90
Ceres-D.C. x Mercury	Ns. 3103	12312	32.9	59.0	13.2	12.7	73.8	.63	62	2.0	707	715	769	730	150	88	88
Pilot x Mida	1772	-----	31.7	58.8	12.9	12.1	74.2	.62	60	2.0	715	744	732	744	148	82	80
Mida x Cadet	1831	12363	37.6	59.7	12.5	11.6	73.9	.55	62	2.0	741	694	732	741	149	87	90
N. 1511 x N. 1441	1719	-----	36.2	60.7	13.7	13.0	71.3	.63	63	2.0	726	698	735	720	151	80	85
N. 1441 x Renown	1832	-----	29.0	59.3	12.4	11.9	73.4	.64	60	2.0	621	724	778	708	149	72	83
Pilot x Mida	1785	-----	33.9	60.2	13.4	12.6	73.5	.55	60	2.0	723	680	716	723	147	90	85
Pilot	1098-13	11945	34.3	60.6	12.9	12.0	72.1	.51	60	2.0	735	663	707	735	146	85	83
Mida x N. 1315	1828	-----	29.0	58.9	13.2	12.8	71.7	.52	62	2.0	634	696	755	695	150	90	88
Merit x Pilot	1830	12364	33.9	60.1	12.3	11.7	71.1	.61	64	2.0	660	662	729	684	152	83	90
Pilot x N. 1315	1829	12353	32.2	60.0	12.4	11.6	73.2	.47	60	2.0	677	623	704	668	149	83	85
Comet-1110 x H-44-Ceres	1586-4	-----	34.4	61.4	11.7	10.8	74.8	.50	60	2.0	665	643	696	668	149	80	83
Rel.-Hope x H-44-Ceres	1706	-----	32.6	61.0	12.9	12.5	74.4	.66	62	2.0	649	652	683	661	150	77	83
Merit x Thatcher	1763	-----	29.9	60.0	13.4	13.0	70.9	.55	64	2.0	652	649	668	656	152	77	77
Rel.-Hope x H-44-Ceres	1797	-----	32.1	61.7	12.8	12.4	72.6	.56	65	2.0	662	628	655	662	154	83	83
Rel.-Hope x H-44-Ceres	1796	-----	26.5	61.3	12.9	12.1	72.2	.61	60	2.0	640	606	631	640	149	75	80
Average			32.5	60.2	12.8	12.1	72.9	.57	62	2.0	686	675	724	695	150	83	85
Range			11.1	2.9	2.0	2.2	3.9	.17	5	0.0	131	136	181	172	8	15	13
1/ Standard error (variety x method interaction) for a single determination = 32.0 cc. Significant difference = 64.0 cc.																	
Nursery Increase																	
Regent x Pilot	1753	12317	----	60.2	14.8	13.9	71.1	.60	63	2.0	803	801	903	836	148	90	85
Thatcher	----	10003	----	60.4	13.7	13.5	73.3	.61	62	2.0	755	741	735	755	150	85	90
Comet-Pilot x C.-1121	1689	12262	----	59.5	13.2	12.8	73.6	.63	64	2.0	637	681	769	696	151	88	82

1/ Comet-Pilot x Comet-1121.



Table 7.--(Continued)

Langdon, N. Dak.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking methods, and loaf volume <sup>1</sup>				Average	
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti-mum	Weight of loaf	Crumb and color texture
			(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)
Pilot (check)	1098-13	11945	33.0	60.0	14.7	14.3	71.3	.44	60	2.0	809	845	905	853	146	90 87
Regent x Pilot	1849		29.5	61.4	15.3	14.6	71.8	.49	62	2.0	733	809	853	853	149	78 80
N. 1449 x Pilot	1845		28.5	60.0	13.6	12.7	72.6	.43	62	2.0	704	781	856	856	149	87 90
Pilot x Merit	1774		30.4	59.7	15.3	14.0	71.5	.47	64	2.5	668	763	848	848	150	85 85
N. 1441 x N. 1444	1848		29.8	60.4	14.5	14.0	73.1	.40	63	3.0	689	718	836	836	149	75 88
Pilot x Mida	1775		33.0	62.0	15.7	15.6	71.9	.48	60	2.0	707	744	792	792	148	87 88
Mida (check)	Ns. 2829	12008	35.3	62.2	15.9	15.4	74.5	.46	63	2.0	649	761	824	824	150	87 83
N. 1441 x Renown	1883	12361	30.7	61.6	14.5	13.8	73.1	.40	63	2.0	671	720	798	798	151	83 80
N. 1449 x Pilot	1846		30.6	61.7	14.6	13.9	73.3	.47	60	2.0	649	755	775	775	148	70 80
Comet-1110 x Pilot	1663-1		31.1	61.6	14.8	14.3	71.6	.45	60	2.0	683	738	781	781	147	80 83
Comet-1110 x Pilot	1838		35.3	61.1	14.4	13.5	72.9	.44	60	2.0	671	738	758	758	148	80 85
Mida x Cadet	1835		34.0	61.7	14.0	13.5	74.9	.45	60	2.0	652	709	769	769	150	88 83
Pilot x Mida	1751		37.6	62.2	14.7	14.3	73.2	.42	60	2.0	623	729	772	772	149	82 82
Pilot x Mida	1834		31.5	61.2	15.2	14.9	75.5	.47	63	2.0	603	720	769	769	152	72 80
N. 1504 x N. 1448	1837		36.6	61.8	14.0	13.2	71.2	.39	60	2.0	674	709	701	709	147	82 83
Comet-1121 x C.H.F.	1836		32.5	63.0	14.1	13.5	74.3	.48	60	2.0	598	696	753	753	150	75 83
N. 1507 x II-28-68	1847		27.6	61.1	15.1	14.9	71.6	.53	62	2.0	614	628	634	634	153	60 70
Average			32.2	61.3	14.7	14.1	72.8	.45	61.2	2.1	670	739	790	790	149	80 83
Range			10.0	3.3	2.3	2.9	4.3	.14	4.0	1.0	211	217	271	271	7	30 20

<sup>1</sup> Standard error (variety x method interaction) for a single determination = 28 cc. Significant difference = 57 cc.

Table 7.--(Continued)

Dickinson, N. Dak.

Variety or cross	Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average.	Mixing time	Baking method and loaf volume 1/				Average			
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Opti-mum	Aver-age	Weight of loaf	Grain Crumb and color texture	
(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Min.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)	(Score)	(Score)				
Ceres-Pilot	1535	12367	28.5	57.0	16.5	15.8	72.5	.50	60	2.0	881	1039	992	1039	971	146	93	85
Regent x Mida	1890		30.4	58.8	16.5	16.0	72.5	.42	60	1.5	864	1038	986	1038	963	147	92	88
N. 1556 x N. 1563	1840		28.3	57.6	16.1	15.4	72.5	.40	60	1.5	795	934	980	980	903	147	88	85
Hope-Ridit-Reward x Komar-Hussar-Hope-Reward	1891		26.1	58.6	16.5	15.9	72.3	.47	60	1.5	721	939	936	939	865	148	77	85
Comet-Pilot	1643		28.3	59.1	15.9	15.0	72.6	.45	60	1.5	750	854	917	917	840	149	75	83
Merit x H-44-Ceres x Kom.-Rid.	1728		33.6	58.5	15.7	15.0	74.5	.48	60	2.0	715	879	916	916	837	148	75	87
Mercury x Komar-Hussar	1801		25.7	57.8	16.4	15.6	72.6	.46	62	2.0	741	868	903	903	837	148	87	93
Regent x Mida	1889		30.8	58.5	16.2	15.6	74.4	.38	60	2.0	721	885	865	885	824	148	80	88
Komar-Hussar x Hope-Ridit-Rew.	1735		26.3	59.5	16.6	15.8	72.7	.46	62	2.0	750	821	842	842	804	149	97	88
Mercury x Komar-Hussar	1894		27.7	58.4	16.1	15.3	74.7	.44	60	2.0	663	830	888	888	794	147	80	88
Thatcher	(Check) 1003		27.4	59.7	16.9	16.7	72.4	.42	62	1.5	666	824	885	885	792	149	78	80
Ceres-N. 1308 x Mercury	1893		31.7	58.5	16.1	14.8	74.7	.45	60	1.5	668	812	824	824	768	148	80	92
H-44 x Ceres-Komar-Ridit	1809		25.0	56.3	15.7	15.0	72.8	.42	60	1.5	693	781	772	781	749	148	77	82
H-44 x Ceres-Komar-Ridit	1892		27.2	57.0	15.8	15.2	74.7	.46	60	1.5	640	798	767	798	735	149	75	88
Mercury x Komar-Hussar	1649		27.6	58.3	15.9	14.9	72.3	.43	62	2.0	677	741	766	766	728	150	82	90
Ceres x Hope-Ridit	1534	12039	29.3	59.0	16.7	16.0	71.9	.50	60	2.0	637	741	769	769	716	148	79	82
Average			28.4	58.3	16.2	15.5	73.1	.45	60.5	1.8	724	862	876	886	820	148	82	87
Range			8.6	3.4	1.2	1.9	2.8	.12	2	.5	244	298	226	273	255	4	22	13

1/ Standard error (variety x method interaction) for a single determination = 30 cc. Significant difference = 61 cc.



Table 7.--(Continued)

Bozeman, Mont.

Variety or cross	State or Nursery number	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorption average	Mixing time	Baking method and loaf volume				Average	
					Wheat	Flour	Yield	Ash			No. 2	No. 3	No. 6	Optimum	Weight of loaf	Crumb and color texture
Pilot x Merit	1951		(Bu.) 65.6	(Lbs.) 62.5	(Pct.) 13.0	(Pct.) 12.1	(Pct.) 73.0	.44	60	2.0	(Cc.) 665	(Cc.) 692	(Cc.) 733	(Cc.) 733	148	(Score) 88
Thatcher (check)		10003	53.1	62.1	12.9	12.3	74.2	.40	64	2.0	603	712	755	755	153	87
Thatcher x Marquis	1946		61.6	63.0	13.1	12.6	73.7	.46	62	2.0	573	674	746	746	151	85
Mida x N. 1529	1949		64.1	62.9	12.0	11.1	73.7	.44	63	2.0	606	655	709	709	152	77
Pilot x Mida	1773		66.8	63.3	13.2	12.2	74.5	.43	62	2.0	600	657	712	712	152	88
Pilot (check)	1098-13	11945	58.6	62.3	12.0	11.2	74.3	.45	60	2.0	649	626	693	693	149	87
Rel.-Hope x Comet-1121	1940		65.1	63.0	12.5	11.4	74.7	.41	60	1.5	598	640	704	704	148	88
N. 1248 x Merit	1944		55.8	61.3	14.2	13.5	74.9	.53	65	2.0	539	629	724	724	155	78
Pilot x N. 1315	1941		56.2	64.0	12.1	11.0	74.6	.47	65	2.0	539	623	692	692	155	73
Regent x N. 1315	1950		64.1	62.3	12.8	12.5	75.3	.44	63	2.0	579	603	668	663	153	68
N. 1441 x N. 1444	1943		61.5	62.2	12.3	11.8	74.3	.39	62	2.0	621	579	649	649	151	83
Merit x N. 1315	1948		60.3	61.3	11.2	10.2	74.7	.44	64	2.0	535	561	671	671	154	78
N. 1441 x N. 1508	1695		66.5	63.3	11.7	11.1	73.1	.39	60	2.0	579	570	629	629	150	80
Rel.-Hope x H-44-Ceres	1717		64.3	62.8	12.1	11.0	74.7	.54	63	2.0	548	570	643	643	155	67
Merit x Pilot	1942		61.4	61.8	13.1	12.6	72.4	.44	61	2.0	530	524	598	598	152	73
N. 1248 x Pilot	1945		63.9	62.5	13.5	12.3	75.3	.44	60	1.5	506	530	579	579	153	70
Thatcher x Ceres	1947		58.8	62.4	12.5	11.7	73.5	.48	61	2.0	518	483	545	545	152	63
Average			61.9	62.6	12.6	11.8	74.2	.45	62.0	1.9	579	608	674	674	152	78
Range			11.0	2.7	3.0	3.3	2.9	.14	5.0	.5	159	229	210	210	7	21

1/ Standard error (variety x method interaction) for a single determination = 29 cc. Significant difference = 60 cc.

## BROMATE RESPONSE METHODS

The response to varying amounts of potassium bromate (0 to 3 mg. per 100 g. of flour) is shown in table 8. Samples of 4 hard red spring wheats and 4 hard red winter wheats were again obtained from Sheridan, Wyo., where they were grown on similarly prepared fallow, to determine if comparable high protein spring wheats would respond to increasing amounts of bromate as has been found for the winter wheats tested in the Hard Winter Wheat Quality Laboratory. Peck samples of each of the 8 varieties were milled on the Buhler mill. The baking results shown in table 8 show that the spring and winter wheats again responded alike, producing the largest loaf volumes when 2 milligrams of bromate were used. These results, as in 1942, show a higher bromate requirement for the spring wheat as compared with the 1940 and 1941 crop, where on the average 1 mg. of bromate produced the largest loaf volume. There was less difference in the bromate response of the hard red winter wheats than in the 1942 crop, but it should be pointed out that the 1943 hard winter wheats averaged nearly 1 percent lower in protein content than in 1942.

## U. S. D. A., MINNESOTA, AND NORTH DAKOTA METHODS

The same composite flours of seven uniform varieties for the eastern and western sections were baked a third year by different methods including those used by the Minnesota and North Dakota laboratories. The results from the regular methods, modifications of the No. 6 method, and methods used by the laboratories are shown in table 9.

Slightly larger volumes were obtained by the No. 6 method when 0.1 percent of phosphate was used but this or the use of 3 percent yeast did not increase the volumes of the higher protein western composite samples as did 2 mg. of bromate.

The results from the Minnesota methods using the 2-minute mix only gave best results for 2-hour fermentations. Some of the varieties, especially Cadet, gave optimum volumes for the 3-hour fermentation. The volumes are higher this year than the No. 2 bake of the regular U. S. D. A. methods and about equalled the No. 3 method. These larger loaf volumes are due in part to not scaling the dough to a uniform weight of 150 g. for all varieties as is done in the Minnesota laboratory. The Eastern Composite samples baked by the Minnesota methods averaged higher than the Western Composite samples in loaf volume, while the protein content is lower.

The results from the North Dakota malt-phosphate-bromate method shown in table 9 are given for both 2- and 3-hour fermentation periods. As with the Minnesota methods, the 2-hour period gave best results. Certain varieties, especially Pilot, are severely injured by over-fermenting. The 2-hour fermentation volumes are larger than those from the regular No. 6 method of the U. S. D. A., laboratory. Of the 11 methods, it seems the most promising.

The volumes for the different laboratory methods and averages for 11 methods are shown in table 8. The varieties are arranged in descending order of the average loaf volume. For the Eastern Composite Cadet, Regent, and Newthatch and for the Western Composite Ceres, Thatcher, and Marquis led. The average of Eastern and Western composites shows Pilot, Thatcher, and Cadet to lead.

## COMMERCIAL GRADE SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Office of Distribution for comparison with the varieties and strains produced in experimental plots. Nine such samples, representing a number of grades and types, were obtained at Minneapolis, Minn., Spokane, Wash., and Great Falls, Mont. The samples were composited by grade from cars of wheat grading No. 3 or better and represent the better grades of hard red spring wheats received at these markets. The quality results are given in table 10.

These samples average lower in protein content than the experimental plots and nursery samples. Otherwise the milling, baking, and chemical results do not appear to be greatly different, especially when based on samples having approximately the same test weight and protein content.



Table 8.--Yield, milling, baking, and chemical results on 4 hard red spring wheats and 4 hard red winter wheats, baked by methods to show bromate response on the two classes of wheat, grown on comparable fallow land at Sheridan, Wyo., in 1942-1943

Variety or cross	C. I. number	Acre yield	Test weight	Protein content		Flour		Water absorp- tion aver- age	Milligrams of bromate and volume of loaf				Average			
				Wheat	Flour	Yield	Ash		0	1	2	3	Opti- mum	Aver- age	Weight of loaf	Crumb color and texture
(Bu.)	(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Cc.)	(Grams)(Score)	(Score)				
Hard Red Spring																
Pilot	11945	40.7	58.1	15.2	14.0	69.1	.48	63	845	862	896	934	884	148	88	83
Rival	11708	32.4	58.0	15.6	14.9	62.9	.62	64	743	868	928	928	841	149	87	78
Ceres	6900	36.7	59.3	15.7	15.0	68.3	.60	66	783	850	859	812	859	150	86	83
Thatcher	10003	38.8	59.2	15.9	15.4	65.2	.66	64	714	758	775	792	759	151	70	71
Average		37.2	58.7	15.6	14.8	66.4	.59	64	771	834	865	841	878	150	83	79
Range		8.3	1.3	.7	1.4	6.2	.18	3	131	112	153	142	142	3	18	12
Hard Red Winter																
1/ Standard error (variety x method interaction) for a single determination = 35 cc. Significant difference = 79 cc.																
Nebred	10094	44.0	61.1	14.3	13.5	71.7	.45	62	769	842	833	859	826	147	71	80
Minturki	6155	47.7	59.1	15.2	13.7	60.6	.47	60	712	732	821	775	760	147	71	74
Kanred	5146	37.9	60.0	14.3	13.5	62.5	.54	60	660	693	718	723	699	148	81	80
Karmont	6700	36.4	59.5	15.2	14.9	71.9	.62	62	576	643	703	720	661	148	72	74
Average		41.5	59.9	14.8	13.9	66.7	.52	61	679	728	769	781	737	148	74	77
Range		11.3	3.0	.9	1.4	11.3	.17	2	193	199	130	139	165	1	10	6

1/ Standard error (variety x method interaction) for a single determination = 24 cc. Significant difference = 53 cc.

Table 9.--Uniform varieties, 1943, composited from Eastern and Western stations, milled on Buhler mill, and baked by 11 methods

Variety	U. S. D. A.			No. 6 with addition of ---				Minnesota Methods			North Dakota Methods			11 Methods
	Regular Methods			Phosphate Bromate Yeast				2 Minute Mix			Malt-Phosphate-Bromate			
	No. 2	No. 3	No. 6	0.1 pct.	2 mg.	3 mg.	3 pct.	2 hrs. fer.	3 hrs. fer.	2 hrs. fer.	3 hrs. fer.	Average		
<u>Eastern Composite</u>														
Cadet	698	865	911	937	925	899	905	842	870	968	956	889		
Regent	761	845	914	943	905	930	883	888	853	928	922	888		
Newhatch	809	877	933	931	875	902	879	900	812	916	905	885		
Pilot	830	894	899	945	859	827	859	900	766	922	766	866		
Rival	809	854	883	945	812	873	865	830	783	974	888	865		
Renown	704	815	865	903	859	865	885	806	818	928	870	847		
Thatcher	729	836	876	881	827	833	839	806	749	865	806	822		
Average	763	855	897	926	866	884	874	853	807	929	873	866		
Range	132	79	68	64	113	97	66	94	121	109	190	67		
<u>Western Composite</u>														
Ceres	795	882	948	917	931	922	862	896	842	974	905	898		
Thatcher	795	853	903	922	911	881	809	859	783	1009	928	878		
Marquis	732	862	919	876	920	906	868	870	755	916	836	860		
Pilot	798	847	873	889	827	772	732	876	755	986	888	840		
Rival	709	781	876	842	874	830	766	744	744	859	818	804		
Cadet	621	717	862	827	833	830	726	789	789	916	859	797		
Regent	634	738	833	827	876	848	755	755	755	842	812	789		
Average	726	811	888	871	882	856	788	827	775	929	864	838		
Range	177	165	115	95	93	150	142	152	98	117	116	109		
<u>Average Eastern and Western Composites</u>														
Pilot	814	871	886	917	842	830	796	888	761	954	827	853		
Thatcher	762	845	890	902	869	857	824	833	766	937	867	850		
Cadet	660	791	837	882	879	865	816	816	830	942	908	843		
Regent	698	792	874	885	891	889	819	822	804	885	867	839		
Rival	759	818	880	894	843	852	816	787	764	917	853	835		
Average	739	823	883	896	865	859	814	829	785	927	864	844		
Range	157	80	16	35	48	59	28	101	69	69	81	18		



Table 10.--Milling, baking, and chemical results on nine composite samples of commercial/hard red spring wheat obtained at Minneapolis, Minn., Great Falls, Mont., and Spokane, Wash., representing the 1943 crop grades of

Location where obtained	Samples com- posited from car lots	U.S. Grade	Test weight	Protein content		Flour		Water absorp- tion aver- age	Mix- ing time	Baking method and volume of loaf			Average					
				Wheat	Flour	Yield	Ash			No.2	No.3	No.6	Opti- mum	Aver- age	Weight of loaf	Crumb color	Grain and texture	
																		(Pct.)
			(Lbs.)	(Pct.)	(Pct.)	(Pct.)	(Pct.)											
Minneapolis, Minn.	80	1 Hvy.D.N.S.	61.5	13.3	12.7	72.8	.52	60	2.0	705	747	800	800	751	148	82	85	
Do.	326	1 D.N.S.	59.7	13.4	13.0	73.3	.54	60	2.0	701	775	804	804	760	148	78	87	
Do.	199	2 D.N.S.	58.6	13.9	13.7	72.7	.53	62	2.5	764	839	874	874	826	149	85	87	
Do.	230	3 D.N.S.	57.2	13.9	13.3	72.2	.59	62	2.5	792	850	882	882	841	148	82	88	
Do.	30	1 N.S.	60.1	13.0	12.3	73.9	.49	60	2.0	729	784	787	787	760	148	88	88	
Spokane, Wash.	52	1 Hvy.D.N.S.	61.0	14.3	13.8	71.5	.56	62	2.0	701	821	862	862	795	149	87	87	89
Do.	94	1 D.N.S.	59.5	14.7	14.1	71.6	.50	63	2.0	686	801	851	851	779	151	82	82	
Great Falls, Mont.	299	1 Hvy.D.N.S.	61.9	13.7	13.5	72.3	.45	64	2.0	752	801	891	891	815	151	87	87	
Do.	197	1 D.N.S.	59.8	15.2	14.6	71.5	.45	63	2.0	649	812	885	885	782	149	82	80	
Average			59.9	13.5	13.4	72.4	.51	61.8	2.1	720	801	848	848	790	149	84	86	
Range			4.7	2.2	2.3	2.4	.14	4.0	.5	106	103	104	104	90	3	10	8	

Table 11.--Average of the milling, baking and chemical properties of 15 wheats, the average of comparable samples of Thatcher, and of each variety in percentage of Thatcher, with the varieties arranged in order of percentage for average loaf volume, 1943

Variety or Cross	No. of samples	Test weight (lbs.)	Crude protein of wheat (Pct.)	Yield of flour (Pct.)	Ash in flour (Pct.)	Water absorption average (Pct.)	Baking methods and volume of loaf				Crumb color	Grain and texture
							No. 2	No. 3	No. 6	Optimum	Average	(Score)
Ceres	7	58.5	15.7	71.1	.52	62.6	785.	848.	918.	918.	850.	82.
Thatcher	7	58.3	15.5	70.9	.52	62.4	737.	826.	895.	895.	819.	83.
Percentage of Thatcher	100.0	101.3	100.3	100.0	100.0	100.3	106.5	102.7	102.6	102.6	103.9	98.8
Regent x Pilot, N. 1753	3	58.7	15.9	70.1	.53	64.0	797.	918.	938.	938.	901.	86.
Thatcher	3	57.4	15.2	72.1	.56	60.7	796.	894.	917.	923.	869.	81.
Percentage of Thatcher	102.3	104.6	97.2	103.6	105.4	105.4	100.1	102.7	107.7	107.0	103.7	106.2
Pilot	14	58.7	14.6	70.8	.52	61.1	777.	834.	885.	885.	832.	88.
Thatcher	14	58.6	14.7	71.0	.53	62.0	717.	814.	880.	880.	805.	83.
Percentage of Thatcher	100.2	99.3	98.7	98.1	98.5	98.5	108.4	102.5	100.6	100.6	103.4	106.0
Rival	12	58.7	15.2	73.0	.60	63.9	738.	821.	889.	891.	816.	87.
Thatcher	12	58.1	15.0	70.6	.55	62.2	725.	829.	893.	893.	816.	83.
Percentage of Thatcher	101.0	101.3	103.4	109.1	102.7	102.7	101.8	99.0	99.6	99.8	100.0	104.8
Newthatch	12	57.4	15.6	72.5	.60	62.0	715.	814.	878.	882.	803.	80.
Thatcher	12	58.3	14.7	71.5	.56	61.6	715.	814.	883.	883.	805.	83.
Percentage of Thatcher	98.5	106.1	101.4	107.1	100.6	100.6	100.1	100.0	99.4	99.9	99.8	96.4
Mida	8	60.9	15.5	74.0	.54	61.3	715.	796.	860.	860.	790.	90.
Thatcher	8	58.5	14.4	72.6	.57	61.0	712.	817.	872.	872.	800.	83.
Percentage of Thatcher	104.1	107.6	101.9	94.7	100.5	100.5	100.4	97.4	98.6	98.6	98.8	108.4
Marquis	8	58.5	15.1	70.2	.54	60.3	732.	830.	875.	877.	813.	86.
Thatcher	8	58.0	16.0	70.7	.49	61.9	728.	842.	911.	911.	827.	81.
Percentage of Thatcher	100.9	94.4	99.3	110.2	97.4	97.4	100.5	98.6	96.0	96.2	98.3	106.2
Rival x Thatcher, S. D. 2259	3	56.4	16.1	72.3	.55	62.0	791.	917.	959.	959.	889.	84.
Thatcher	3	55.4	15.7	71.1	.58	60.0	841.	956.	981.	981.	926.	81.
Percentage of Thatcher	101.8	102.5	101.7	94.8	103.3	103.3	94.1	95.9	97.8	97.8	96.0	103.7
Renown	7	59.2	15.4	72.0	.59	60.4	682.	812.	874.	877.	789.	80.
Thatcher	7	57.7	14.4	70.6	.60	61.6	731.	849.	894.	894.	826.	84.
Percentage of Thatcher	102.6	106.9	102.0	98.3	98.1	98.1	93.3	95.6	97.8	98.1	95.5	95.2
Cadet	13	57.4	15.3	71.4	.60	64.6	660.	783.	859.	860.	768.	83.
Thatcher	13	58.3	14.8	70.8	.56	62.0	722.	819.	885.	885.	809.	83.
Percentage of Thatcher	98.5	103.4	100.8	107.1	104.2	104.2	91.4	95.6	97.1	97.2	94.9	100.0
Vesta	4	61.4	15.1	75.1	.56	62.2	648.	756.	824.	824.	742.	87.
Thatcher	4	60.4	14.8	73.1	.52	62.0	676.	798.	876.	876.	783.	83.
Percentage of Thatcher	101.7	102.0	102.7	107.7	100.3	100.3	95.9	94.7	94.1	94.1	94.8	104.8
Regent	12	58.6	15.7	72.2	.55	61.8	677.	786.	848.	851.	770.	77.
Thatcher	12	58.1	15.0	70.6	.55	62.2	725.	829.	893.	893.	816.	83.
Percentage of Thatcher	100.9	104.7	102.3	100.0	99.4	99.4	93.4	94.8	95.0	95.3	94.4	92.8
Henry	6	58.9	14.2	73.7	.54	60.3	695.	805.	859.	859.	786.	75.
Thatcher	6	58.3	14.9	73.5	.54	60.3	787.	895.	925.	925.	808.	81.
Percentage of Thatcher	103.0	95.3	102.5	93.1	99.3	99.3	88.3	89.1	90.8	90.8	89.5	91.5
Bel-Hope x Comet-1121, N. 1520	12	58.1	14.8	73.4	.53	60.2	682.	798.	801.	801.	734.	76.
Thatcher	12	57.8	15.0	72.3	.55	61.2	740.	844.	908.	908.	831.	80.
Percentage of Thatcher	102.2	99.3	101.5	96.4	98.4	98.4	89.5	87.4	88.2	88.2	88.3	93.7





Table 12.---(Continued)

Variety, State or Nursery No.	Loaf volume, optimum					Variety State or Nursery No.	Loaf volume, average					Aver- age.	
	1938	1939	1940	1941	1942		1943	1940	1941	1942	1943		
N. No. 1753						107.0						103.7	103.7
Newthatch						101.6						99.8	101.2
Renown	96.3	98.9	97.4	103.4	103.0	99.9						102.6	101.2
Regent	106.6	99.7	100.5	102.0	103.7	98.1	102.7	97.3	99.0	100.1	103.0	103.4	100.9
Thatcher	100.0	100.0	100.0	100.0	103.1	95.3	98.0	95.4	100.0	102.7	102.9	95.5	100.2
					100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cadet						99.4	98.7	97.2	95.4	98.1	101.8	103.9	99.5
Pilot	99.3	96.0	98.5	100.0	101.4	100.6	101.6	98.6	99.8	102.8	101.9	94.4	99.4
S.D. 2259					100.6	97.8					101.1	96.0	98.9
Ceres	97.3	91.9	90.2	99.4	100.8	102.6					98.4	94.9	97.7
Rival	97.3	93.9	92.1	96.6	101.2	99.8	99.0	94.0	91.0	95.9	101.0	100.0	97.0
Marquis	94.3	90.9	91.9	98.8	95.7	96.2	96.5	93.6	91.9	98.1	95.6	98.3	95.8
Vesta	96.2	87.3	94.2	97.5	98.9	94.1	96.6	88.2	94.4	96.4	99.0	94.8	94.8
Mida		88.4	89.0	91.4	98.2	98.6		91.5	89.2	91.9	98.6	98.8	94.0
Henry					98.9	90.8		90.9	90.7	95.5	97.1	88.3	92.6
N. No. 1520		86.4	92.3	96.8	96.4	88.2					96.5	89.5	91.8

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Variety, State or Nursery No.	Crumb color, average all methods					Variety, State or Nursery No.	Grain-texture, average of all methods					Aver- age.	
	1938	1939	1940	1941	1942		1943	1938	1939	1940	1941		1942
Mida						108.4							103.4
N. No. 1753						106.2							101.4
Vesta	112.3	96.4	103.6	103.5	112.0	104.8	104.6	99.9	97.0	101.2	102.3	103.6	101.2
Cadet			101.1	111.1	105.8	100.0	98.4	101.4	98.9	101.2	102.3	101.2	101.2
Pilot	109.5	101.7	100.1	103.6	105.8	106.0			103.4	101.1	101.1	104.7	100.3
S.D. 2259													
Rival	108.9	98.2	96.4	103.6	104.6	103.7			96.6	100.0	101.1	100.0	100.2
Marquis	92.6	104.2	100.0	100.0	105.8	104.8	99.3	99.0	94.3	101.2	101.1	103.6	100.1
Renown	98.2	98.8	101.2	103.6	105.8	95.2			94.4	102.3	101.1	97.6	100.0
Newthatch			94.3	107.6	100.0	96.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	91.1	100.8	98.9	100.0	100.0	102.5	99.9
Regent	97.5	95.7	97.7	102.7	103.5	92.8	93.7	103.7	95.3	101.2	98.8	103.7	99.5
Ceres	95.3	100.0	95.2	100.0	103.0	98.8	97.7	93.1	96.6	98.8	104.6	100.0	98.2
N. No. 1520						92.7		97.1	101.1	92.9	97.7	96.4	97.5
Henry		95.9	100.0	103.7	90.0	91.5	95.9	93.5	93.3	93.9	98.8	96.4	96.4
						91.8					100.0	98.8	96.4



Table 12.--(Continued)

Variety, State or Nursery No.	Water absorption of flour					Variety, State or Nursery No.	Loaf volume, commercial method, no. 2					Average		
	1938	1939	1940	1941	1942		1943							
Cadet	---	---	109.2	104.8	106.7	104.2	105.6	105.5	101.0	100.9	100.9	106.5	108.4	103.9
N.No. 1753	---	---	---	---	---	105.4	105.4	---	---	97.6	102.4	102.9	100.1	101.5
Rival	103.9	100.5	102.2	103.2	105.0	102.7	103.0	102.0	96.8	95.3	98.4	105.5	106.5	101.1
S.D. 2259	---	---	---	---	100.8	103.3	101.9	---	---	---	---	---	100.0	100.1
Newthatch	---	---	104.6	101.1	102.1	100.6	101.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	102.9	97.7	101.5	103.2	101.6	100.3	101.4	---	---	---	---	102.1	94.1	98.7
Regent	100.7	99.1	100.5	101.6	101.6	99.4	100.6	93.7	96.6	98.5	98.1	99.7	99.4	98.5
Vesta	101.0	99.8	100.0	101.6	98.4	100.3	100.3	101.0	95.5	93.3	95.2	100.7	101.8	98.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	95.0	91.9	98.7	98.9	100.9	93.3	97.5
Mida	---	97.3	99.8	98.4	101.6	100.5	99.8	98.6	97.8	93.0	96.7	95.3	100.5	96.6
Renown	100.0	99.7	98.8	100.0	100.0	98.1	99.5	---	96.1	91.9	92.7	100.1	100.4	95.8
Henry	---	---	---	---	100.0	99.3	99.5	96.0	91.5	95.0	96.3	100.4	95.9	95.7
Pilot	97.8	98.9	100.5	100.0	100.0	98.5	99.4	---	---	96.1	97.5	94.7	91.4	94.4
N.No. 1520	---	96.8	97.7	98.4	100.0	98.4	98.8	---	93.6	92.1	96.0	99.0	89.5	94.0
Marquis	100.0	94.8	97.1	100.0	100.0	97.1	98.4	---	---	---	---	92.2	88.3	89.6

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Variety, State or Nursery No.	Loaf volume, method no. 3					Variety, State or Nursery No.	Loaf volume, method no. 6					Average		
	1938	1939	1940	1941	1942		1943							
N.No. 1753	---	---	---	---	---	102.7	102.7	---	---	---	---	107.7	107.7	
Newthatch	---	---	98.7	100.6	101.6	100.0	100.6	---	---	97.4	103.7	103.3	99.4	101.6
Pilot	106.8	96.2	98.2	99.8	102.0	102.5	100.5	93.9	98.8	100.4	102.5	104.6	97.6	101.0
Regent	100.6	98.9	100.9	105.1	102.6	94.8	100.3	109.8	100.1	99.9	105.0	103.6	95.0	100.9
Renown	97.5	95.1	100.7	101.4	104.1	95.6	100.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	---	---	97.9	102.2	100.5	97.1	99.7
Cadet	---	---	99.0	100.9	100.0	95.6	98.8	---	---	---	---	100.7	97.8	99.5
S.D. 2259	---	---	---	---	100.8	95.9	98.7	97.3	95.8	98.0	99.6	101.1	100.6	99.0
Ceres	100.6	92.3	89.5	96.8	101.4	102.7	97.6	95.6	91.8	89.9	99.1	100.2	102.6	97.3
Rival	100.7	92.3	89.5	96.8	101.4	99.0	96.3	95.4	94.2	90.3	97.1	101.7	99.6	96.8
Marquis	96.5	82.6	82.6	98.4	96.5	98.6	96.2	94.2	90.9	90.2	99.3	95.3	86.0	84.8
Vesta	96.6	86.6	84.2	91.4	97.8	94.4	93.0	97.0	87.2	94.2	95.4	88.3	86.0	84.4
Mida	---	91.4	87.3	91.5	97.5	89.1	91.9	---	87.7	88.8	91.5	93.4	90.6	89.5
Henry	---	---	---	---	---	---	---	---	87.7	88.8	91.5	93.4	90.6	89.5
N.No. 1520	---	86.4	88.6	93.7	96.4	87.4	91.4	---	93.0	91.9	96.9	96.8	88.2	92.8

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In table 11, the properties of the 1943 samples of 14 varieties or strains of hard red spring wheat are compared with those of Thatcher wheat. The varieties are arranged in order of their average loaf volume for the 3 baking methods. The results are in general agreement with the 6-year averages.

## COMPARABLE SAMPLES, 1938 to 1943

Table 12 gives the 6-year averages of the milling, baking, and chemical properties of 15 varieties and strains, together with the averages of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. From 3 to 74 comparisons were made for these wheats. The more important quality comparisons shown in the summary table 12 will be discussed in relation to Thatcher as 100 percent.

Hybrid strains named since the last mimeographed report was issued in January are:

Name	Cross	N. No.	C.I. No.
Mida	Ceres-Double Cross (R.L.625) Ceres-Hope-Florence	Ns. 2829	12008
Cadet	Merit x Thatcher	1597	12053

Mida was distributed for commercial growing to North Dakota farmers by the North Dakota Agricultural Experiment Station and Cadet is being increased with a view to distribution in 1945.

Table 13.--Annual and total number of Thatcher samples tested, and comparable samples with Thatcher of 14 other varieties and strains during the 6 years, 1938 to 1943

Variety, State or N. No.	Crop year and number of samples						Total
	1938	1939	1940	1941	1942	1943	
Thatcher	11	12	14	16	18	20	91
Pilot	8	11	14	13	14	14	74
Rival	8	9	9	13	11	12	62
Regent	2	4	7	10	9	12	44
Cadet	-	-	2	10	16	13	41
Marquis	2	4	8	9	9	8	40
Renown	2	3	6	13	8	7	39
Mida	-	2	9	10	7	8	36
Ceres	4	3	6	7	6	7	33
Newthatch	-	-	2	7	12	12	33
N. No. 1520	-	1	2	4	10	12	29
Vesta	8	6	1	5	4	4	28
Henry	-	-	-	-	3	6	9
S. D. 2259	-	-	-	-	4	3	7
N. No. 1753	-	-	-	-	-	3	3



### Thatcher

Thatcher has been a uniform variety in the plot experiments since 1932. It was distributed for commercial growing in 1934. It has shown excellent milling and baking qualities in experimental baking tests and is preferred by the grain trade for a strong type bakers' flour. It is resistant to stem rust, is early, has short, strong straw and yields well. Its commercial acreage increased rapidly until it became the most widely grown variety in 1938. It probably reached its peak in 1941 when it was grown on about 6 million acres in the United States and 9 or 10 million acres in Canada. Being susceptible to leaf rust, it was injured severely in 1938, 1939, and again in 1941 and its acreage has since decreased giving way to Rival and Pilot in the leaf-rust-affected sections. Thatcher replaced Marquis as a standard (100 percent) of comparison in 1939 and as it is still the most widely grown hard red spring variety it is here used as the standard of comparison for the different milling and baking properties. From 1 to 6 years' data are summarized in table 12, giving the relative rank of 15 wheats in percentage of Thatcher, for the principal milling and baking properties.

### Pilot

Pilot has been a uniform variety in plot experiments since 1936 and commercially grown since 1939. It has shown excellent milling and baking qualities in experimental baking tests and is approved by the grain trade for a strong type flour. Pilot is resistant to both stem and leaf rust, to mildew, bunt, and some of the rootrots. It has been the highest yielding of the uniform varieties during the past 6 years, ranking first in four of the years. It has also ranked first for quality in the Eastern and Western composites of the uniform varieties for the region exceeding Thatcher in loaf volume (table 2). The weighted average of 74 comparable samples for 6 years shows Pilot exceeds Thatcher with respect to test weight, ash, loaf volume for methods Nos. 2, 3, and average, and for crumb color and grain and texture. It averages slightly lower than Thatcher for the other properties. In supplemental baking tests Pilot does not usually respond to increasing amounts of bromate and is easily injured by longer mixing and fermentation periods. However, for the average of 11 baking methods (average of Eastern and Western composites), Pilot ranks first in volume among the 5 uniform varieties for the region.

### Rival

Rival was made a uniform variety in 1938 and together with Pilot was distributed for commercial growing in 1939. They have increased to nearly 3 million acres, with Rival exceeding Pilot about 2 to 1 in 1943. Rival has shown good milling and baking qualities in experimental baking tests and is considered satisfactory by the grain trade. Both Pilot and Rival are awned wheats and do not have as strong straw as desired for the heavier soils in the eastern section. Among the uniform varieties Rival has yielded less than Pilot but more than Thatcher during the past 6 years for the region and has yielded much better in the eastern than in the western sections. The weighted average of 62 comparable samples for 6 years show Rival to exceed Thatcher with respect to test weight, flour yield, water absorption, crumb color, and grain texture. Of the 15 wheats shown in table 12, it ranks tenth in average loaf volume.

### Ceres

Ceres has been a uniform variety since the start of the coordinated regional program in 1929. It was distributed in 1926 and increased rapidly, exceeding Marquis in acreage by 1934. In the bad rust years of 1935, 1937, and 1938 it was severely damaged and was gradually replaced by Thatcher. It is still a high-yielding wheat in most of Montana and other sections where stem and leaf rusts do not occur. Ceres has consistently shown good milling and baking qualities in experimental tests and has finally been accepted by the commercial trade. Among the uniform varieties for the western section Ceres has been outyielded by both Thatcher and Pilot. Among the 15 wheats summarized in Table 12, 33 comparable samples of Ceres and Thatcher covering 6 years, show Ceres exceeds Thatcher with respect to test weight, water absorption, and loaf volume for method No. 2. It averages slightly lower than Thatcher for the other properties but ranks sixth for average volume.



### Regent

Regent has been a uniform variety since 1942. It was developed and distributed by the Canadian Department of Agriculture in 1939 and has been grown commercially in the United States since 1940. It is recommended for growing on the heavier soils of the Red River Valley of Minnesota and North Dakota. In the United States, however, it has been damaged by heat and scab and has not been a high-yielding wheat. It has shown excellent milling and baking qualities in experimental tests and is approved by the commercial grain trade. Forty-four comparable tests with Thatcher covering 6 years show it to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, loaf volume for methods No. 3, No. 6, and optimum but lower in other properties. It ranks 6th in average volume among the 15 wheats. Regent samples of the 1943 crop were generally poorer than those from previous seasons and it seems difficult to obtain as satisfactory baking results from the higher protein western samples as from lower protein eastern section samples.

### Renown

Renown has been a uniform variety since 1939. It was developed and distributed in Canada before Regent and has been grown commercially in the United States since 1938. It has not been a high-yielding wheat in experimental tests and was dropped as a uniform variety for the western section in 1943, and the region for 1944. It has shown good milling and baking qualities in experimental tests but has not been approved by the commercial grain trade. During the past 6 years, 39 comparable samples with Thatcher have shown Renown to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, ash, loaf volume for methods No. 3, No. 6, optimum and average, crumb color and grain and texture. Among the 15 varieties it ranks 4th in average loaf volume.

### Marquis

Marquis was a uniform variety for the region from 1929 to 1942 and is still one of the uniform varieties for the western section. It was the leading spring wheat variety of the United States from 1919 to 1934. It was long considered the standard of quality, but since 1938 has been replaced by Thatcher. Marquis is still held in high regard by the commercial trade, although in comparison with newer varieties it has not shown to advantage in experimental yield and quality tests. It is the lowest yielding of the uniform varieties. Among the 15 wheats, 40 comparable samples of Marquis and Thatcher show Marquis to be lowest in test weight, crude protein, flour yield, water absorption, and also to rank lower than Thatcher with respect to loaf volume for all methods and grain texture. It is higher than Thatcher only for crumb color, and ranks 11th for average volume among the 15 wheats.

### Mida

Mida was made a uniform variety for the region in 1944 and was distributed for commercial growing by the North Dakota Agricultural Experiment Station. It has been in plot experiments at the North Dakota and Minnesota stations for 4 years and has been a high-yielding wheat. It is an awned, strong-strawed wheat, resistant to both stem and leaf rusts and to bunt. During 5 years, 36 milling and baking tests show that it exceeds Thatcher with respect to test weight, crude protein of wheat, flour yield, ash, crumb color, and grain texture. It averages lower than Thatcher in water absorption, and all methods of baking used. Among the 15 wheats it ranks 13th in average loaf volume. It was approved by the commercial trade as 'satisfactory for all-purpose bakers' flour.



### Newthatch

Newthatch is a composite of several Hope x Thatcher<sup>3</sup> backcross strains, one of which was a uniform variety for the eastern section in 1942. In 1943 Newthatch replaced the single line as a uniform variety for the eastern section and was made a uniform variety for the region in 1944. By using yields and milling and baking data for the single lines included in the composite, data are available for a 4-year period. The variety was distributed to seed growers by the Minnesota Agricultural Experiment Station in 1944. In the Minnesota plot experiments for 3 years, Newthatch has been outyielded only by Pilot. During a 4-year period of 33 comparable milling and baking tests, Newthatch has exceeded Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, and loaf volume for all methods, crumb color, and grain-texture. It has a higher ash content, which is considered a disadvantage, but ranks 2d. among the 15 wheats, shown in table 12, for average loaf volume.

### Cadet

Cadet is Merit x Thatcher, N. No. 1597, C. I. 12052. It has been a uniform variety for the region for 2 years, 1942 and 1943. It is here named and is being increased with a view for distribution in 1945. Cadet is a midseason, awnleted wheat resistant to both stem and leaf rusts. It has been a high yielding wheat for the region but appears best adapted to the northern part. During a 4-year period 41 comparable milling and baking tests show it to exceed Thatcher with respect to crude protein content of wheat, flour yield, water absorption, and crumb color. It equals Thatcher in test weight and grain and texture but has a higher ash and averages slightly lower in volume, especially for the No. 2 bake. Supplemental baking tests show that it responds sharply to increasing amounts of bromate and withstands longer periods of mixing and fermentation than most varieties. It gives its best results from the malt-phosphate-bromate bake and ranks high in the North Dakota and Canadian Laboratories where this bake is used. It has also ranked high in commercial milling and baking tests for the two years 1942 and 1943.

### Henry

Henry has been the highest yielding wheat in the uniform regional nursery for 2 years, 1942 and 1943, and was increased and distributed by the Wisconsin Agricultural Experiment Station in 1944. It has also been a high-yielding wheat in Wisconsin experiments and has been tested at Minnesota and South Dakota stations with favorable results. During 2 years, 9 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield and has the lowest ash content of the 15 wheats. For the other properties it is exceeded by Thatcher and most of the other varieties and strains averaging 15 or lowest for average loaf volume.

### Vesta

Vesta was distributed for commercial growing by the North Dakota Agricultural Experiment Station in 1941. Its yields in plot experiments in North Dakota were fairly high but its strength of straw and resistance to leaf rust was not as good as desired. During a 6-year period 28 milling and baking tests show it exceeds Thatcher with respect to test weight, flour yield, water absorption, and crumb color. It averages lower than Thatcher for the other properties and ranks 12th among the 15 wheats for average volume for the 3 methods of baking. Commercial milling and baking tests are said to be rather inconsistent for quality and with the distribution of Mida, Vesta has been withdrawn from the recommended list.

S. Dak. 2259

South Dakota 2259 is Rival x Thatcher, C. I. 12272, which has been the second highest yielding wheat in the Uniform Regional Nursery for the 2 years 1942 and 1943. It was developed by the South Dakota Experiment Station and is one of several promising strains in the cross. It is awned and has fair strength of straw and earliness and a good type of kernel. S. Dak. 2259 has been in plot experiments at South Dakota stations for 2 years with good results. Seven milling and baking tests for 2 years show that it exceeds Thatcher with respect to test weight, crude protein content, flour yield, ash, water absorption, crumb color, and grain-texture. It ranks first among the 15 wheats for grain-texture but ranks 8th for average volume.

N. No. 1520

N. No. 1520 is Reliance-Hope x Comet-Reliance-Hope (N. 1121), C. I. No. 12050. It is the third highest yielding wheat in the Uniform Regional Nursery for 2 years, 1942 and 1943. It also has been in plot experiments at 11 stations where it has exceeded Pilot in yield. It is a bearded wheat with strong straw and short, plump kernels which are free threshing and very attractive. During a 5-year period 29 comparable milling and baking tests show it exceeds Thatcher with respect to test weight, flour yield, and ash content. It averages lower than Thatcher for the other properties, ranking 14th among the 15 wheats for average volume. The 1943 samples were consistently poorer than those of the three previous years and one commercial test was declared unsatisfactory.

N. No. 1753

N. No. 1753 is Regent x Pilot (C. I. 12317) which ranked first for average loaf volume from the Eastern and Western composites of the Uniform Regional Nursery in 1943. It also was the outstanding wheat for quality among 24 new wheats tested from the 1943 crop, exceeding the Pilot check for optimum volume by 18 percent in the one test. In the 1943 Regional Nursery it ranked 23 in yield among 26 wheats. In three comparable quality tests with Thatcher in 1943, N. No. 1753 exceeds Thatcher in all properties except flour yield and ash content, and ranks first in optimum and average loaf volume among the 15 wheats here discussed. Of all of the varieties and strains tested during the past 2 years, N. No. 1753 is considered the most outstanding from a quality standpoint.